PROVINCE OF QUEBEC, CANADA

Department of Colonization, Mines and Fisheries

BUREAU OF MINES

Honourable J. E. PERRAULT, Minister - - L. A. RICHARD, Deputy-Minister
THÉO. C. DENIS, Superintendent of Mines

REPORT ON

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

DURING THE YEAR 1922

QUEBEC
PRINTED BY Ls. A. PROULX
PRINTER TO HIS MAJESTY THE KING
1923

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NOTE

In the statistical tables and in the review of the mining industry of the Province during the year, the term "production" is synonymous with "quantity sold or shipped", and does not necessarily represent "output". The ore and other mineral products remaining as "stock on hand" at the end of the year are not included in the production figures.

The ton used throughout is that of 2,000 lb., except when specially mentioned.

The year referred to is the calendar year, ending December 31st unless otherwise stated.

We endeavour to give values of the mineral products, raw or prepared, as estimated at the point of shipment or at the pit-mouth; this, however, is sometimes difficult to obtain.

The present report was preceded, on February 28th, by a statistical statement on the mineral production in 1922, giving provisional figures, subject to revision. The present report gives the revised statistics, and the tables in this volume supersede those of the preliminary statement.

Bureau of Mines,

Quebec, April 30th, 1923.

MINING OPERATIONS

IN THE

PROVINCE OF QUEBEC

DURING THE YEAR 1922

STATISTICAL REVIEW

At the beginning of the year 1922, the mining industry throughout the whole world was at a low ebb, and the Province of Quebec was no exception. This period of depression which had begun to be felt in the spring of 1921, was practically continuous throughout that whole year and the downward curve did not show any rally until April 1922 when a tendency upwards began to assert itself. From that time until the end of the year the improvement was continuous, but without ever being spectacular. As foreseen the recovery and the return to normal conditions are slow, and this is particularly so for the Province of Quebec. In the United States there was a very noticeable revival of activity in metal mining, more particularly in copper, zinc and lead. In Ontario and British Columbia, the great increase in gold production made up to a great extent for the sluggishness in the other branches of mining. But unfortunately the Province of Quebec has so far been a producer of non-metallic minerals rather than of ores of metals, so that the effects of the improvements in the metal markets of the United States was felt less in Quebec than in the Provinces which produce metallic ores. In fact, the whole production of ores of metals in 1922 was limited to a few hundred tons of chromite, and this was, in all probability used in the manufacture of refractory materials.

The reasons for the lethargy of metal mining in Quebec are various. Our cupriferous mines, which four years ago, produced ore valued over $1,300,000, are all closed down, owing to the fact that the sulphur content, which was used for the manufacture of sulphuric acid, before smelting for the recovery of the copper, is no longer in demand, having been entirely replaced by the recent increase of output of the native sulphur deposits of Texas and Louisiana. The molybdenite properties have also been idle since the war, the stocks which had then accumulated not having yet been entirely absorbed. The zinc and lead mines did not reopen, the only activity during the year having been development work on the property of the Federal Zinc and Lead Company, in Gaspé. Canadian chromite, so in demand during the war, has been supplanted in the American market by material from New Caledonia and Rhodesia, which have resumed production on a large scale. The great reduction in ocean freight enables these producers to bring high grade chromite to American ports at much lower prices than Canadian chromite can be produced.

Despite all these adverse facts, the mining industry of the Province of Quebec, at the end of 1922, showed a great improvement as compared with the beginning of that year. It will be observed in the table of production that the quantities of some of the principal items are very much greater than in 1921, but that the values do not show a proportional increase, which indicates lower ruling prices. This state of affairs is an indication of a return to normality rather than otherwise.

The total value of the mineral production of the Province of Quebec in 1922, reached $18,335,153. This is an increase of $2,812,165, or 18.1%, as compared with the figures for 1921, when this value was $15,522,988 which had been the lowest since 1916. Considering the general industrial conditions, the value of the 1922 production is very creditable, and was only surpassed in the three years of 1918, 1919 and 1920; in that latter year it reached the maximum recorded to date of $28,392,939. This is all the more gratifying from the fact that Quebec is not yet a gold producing province, and it is to the increased production of this metal that the increases in most of the other countries are to be attributed.

TABLE OF VALUE IN DOLLARS, OF THE ANNUAL MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC FROM 1902 TO 1922

YEAR	VALUE	YEAR	VALUE
1902	$ 2,985,463	1912	$ 11,187,110
1903	2,772,762	1913	13,119,811
1904	3,023,568	1914	11,732,783
1905	3,750,300	1915	11,765,873
1906	5,019,932	1916	13,287,024
1907	5,391,368	1917	16,189,179
1908	5,458,998	1918	18,707,762
1909	5,552,062	1919	20,813,670
1910	7,323,281	1920	28,392,939
1911	8,679,786	1921	15,522,988
		1922	18,335,153

There has been an adequate supply of labour, reasonable and efficient. The industry has been remarkably free from labour troubles. The railway rates, although very high still, have shown a downward tendency. But on the average they still are about double of the pre-war rates. There has been no dearth of ocean freight, of which the rates have been much lower than for the previous year.

The cost of mining supplies has risen gradually, and in January 1923, they stood at about 12% in advance of the quotations in January, 1922.

TABLE OF THE MINERAL PRODUCTION OF THE PROVINCE OF QUEBEC DURING 1922

Substances	No. of workmen	Wages	Quantities	Value in 1922	Value in 1921
		$		$	$
Asbestos, tons	2,993	2,300,593	163,339	6,053,068	5,199,789
Asbestic, tons			16,011	15,403	14,536
Chromite, tons	20	1,800	767	11,503	22,696
Copper and Sulphur ore, tons	34	28,838	200		10,463
Dolomite, tons	7	5,439	2,614	14,208	8,001
Feldspar, tons	138	57,543	12,472	115,483	79,752
Gold, oz	32	31,536			12,317
Graphite, lb	31	10,145	47,327	1,500	2,422
Kaolin and Fire clay, tons	29	33,254	1,296	18,532	1,987
Magnesite, tons	162	81,730	5,645	76,547	74,110
Mica, lb	147	38,407	890,547	91,001	42,222
Mineral paints (iron oxide, ochre), tons	84	56,136	7,381	113,663	90,765
Mineral water, gal	6	700	12,161	3,692	5,339
Molybdenite, lb	7	2,000			
Phosphate, tons	4	640	131	1,320	453
Quartz & silica rock, tons	46	26,174	10,535	51,025	29,906
Silver, oz					21,339
Talc, tons	16	2,896	203	7,700	
Titaniferous iron ore, tons					
Zinc and Lead ore tons	15	4,710			18,080
Building Materials					
Brick, M	853	644,515	118,399	1,910,355	1,198,471
Cement, bbls	570	645,491	2,660,810	5,906,998	5,410,276
Granite	523	399,493		547,968	369,122
Lime, tons	252	191,331	80,789	666,968	624,574
Limestone, tons	1,342	872,565	1,086,232	1,698,833	1,523,027
Marble, tons	110	139,807	4,437	253,746	167,664
Sand, building, tons	189	11,626	803,959	327,277	263,813
Sandstone, tons	39	16,754	12,362	32,008	2,328
Slate, tons	45	22,383	1,899	14,863	48,766
Tile, drain and sewer pipe, potery, etc	114	87,926		401,492	280,770
Totals	7,808	5,714,432		18,335,153	15,522,988

MINING VENTURES AND THE PUBLIC

A prospecting rush, following some very promising discoveries in the North-western part of the Province of Quebec, is now in full swing, and the staking of claims in the townships of Rouyn, Dasserat, Boischatel, Joannès, Dufresnoy, and surrounding country is at present proceeding with intensity and rapidly. Within the last few months, some 700 claims comprising an area of 100,000 acres, have been staked out. While a number of these may turn out well, and the general geological conditions of the country are favourable to the possibilities of the presence of gold deposits which may eventually turn out into producing mines, there is no doubt that the great majority of the claims staked out, many of them on the snow, will never advance beyond the stage of prospects and assessment work. The opportunity is therefore favourable to the issuance of warning to the interested public, for there is no doubt that the present conditions will give rise to the organization of many ventures whose main object will be to extract money from small investors. Many warnings have been already issued through the annual reports of Quebec Bureau of Mines, guarding the public against the insiduous literature and glowing statements of agents offering mining shares and beautifully engraved certificates, in ventures which have never had a chance of success. A good rule to adopt and follow, on the part of the public, is to take the statements of salesmen of stocks, mining or otherwise, with a great deal of caution and not to invest hard earned savings without first consulting disinterested and competent advisers, such as Bank managers, officials of trust companies, officials of the various Departments of Mines, provincial or federal.

The Quebec Bureau of Mines is entirely at the disposal of the public for technical information regarding the mines and mineral resources of the Province of Quebec. An enquiry on such subjects, addressed to the Department of Colonization, Mines and Fisheries, Quebec, will bring to the writer, information from which he usually can judge of the merits of mining ventures in the Province, and thus enable him to go into it with a better knowledge of the facts. This applies more particularly to intending investors from rural communities or to urban people of small means and hard earned

savings who may be attracted by the lure of returns of one thousand to one on money invested.

As we have already stated in previous reports, the investing public should discriminate between "mines" and "prospects". Some producing mines, or mines well developed, constitute as safe an investment as any other commercial and industrial enterprise, but these rarely yield more than a fair return. On the other hand, "prospecting" and "developing", be it for ores, for natural gas, for oil, are naturally hazardous ventures. When successful, the returns from such investments are large, but failures are infinitely more numerous than successes. Such investments are not for ths small savings, for it should always be remembered that the risk is proportionate to the returns. If the investor expects large returns he has to take risks of losses. And before buying shares in companies searching for, or developing, deposits of gold, lead, zinc, or other minerals, or carrying on boring operations for gas and oil, the public should investigate the statements made by the peddlers of stock certificates, enquire from reliable sources as to the possibilities of the enterprises, so as to be able to discriminate between (1) "safe-mining investments", (2) "legitimate and reasonable mining speculation", and (3) "mining frauds". In the first the returns are not high but are reasonably sure; in the second, the money contributed by the buyers of shares is really expended in intelligent search and development on the mineral deposits, which may or may not answer the hopes which were founded on them; and the third class comprises the ventures of shady adventurers who spend the money obtained from the sale of shares on full page advertisements, in printing alluring and tempting prospectuses for the purpose of obtaining more money, of which the smallest possible fraction is expended in actual work, usually on hopeless mining claims.

RAILWAYS IN NORTH-WESTERN QUEBEC

The extension northward of the Kipawa branch of the Canadian Pacific Railway, which connects the foot of Lake Temiscamingue with the C. P. R. transcontinental line at Mattawa, is now proceeding with all speed, and it is very likely that by the end of the summer 1923, the trains will be running to the Quinze Lake on the

Ottawa river. Previous to this event, the means of reaching the old settled district of Temiscamingue, which comprises flourishing centers of settlement, such as Ville-Marie, Fabre, Lorrainville and others, was by steamer, plying on lake Temiscamingue from the rail terminus at Temiscamingue Junction, to the head of the lake, a run of 45 miles to Ville-Marie, the chief settlement of the district. In winter the only way of ingress and egress was by the Temiskaming and Northern Ontario Railway, as far as Haileybury, then driving over the frozen lake to Ville-Marie, a drive of 15 miles. With the completion of the railway, the heart of the region will be very easy of access, and this will incidentally encourage prospecting, for the mineral possibilities of the region are very attractive.

The new extension, from Temiscamingue to the Quinze river is 68 miles long. The northern terminus, for the present at least, is on the south side of the river, in Baby township, one and a half miles below the outlet of Quinze Lake. The new part of the line starting at Temiscamingue, on the first thirty-five miles, crossing the townships of Gendreau, Mercier, Tabaret and the two eastern corners of Mazenod, runs through an area mapped as granites and gneisses, rather unpromising for mineralization. It then enters the township of Fabre where the outcropping rocks change to typical Keewatin green schists and metamorphosed sedimentaries, such as quartzites, conglomerates, arkose, graywacke and slate, intruded by various igneous rocks, and the same geological conditions obtain in the southern half of the next townships, Duhamel and Laverlochère, immediately to the north of Fabre. The rocks in these three townships are widely but not heavily mineralized, and although all three have seen some mild silver and gold rushes, at various times during the last fifteen years, no deposit of economic value has yet been discovered. The last township through which the railway runs, is Baby, the main portion of which is underlain by metamorphosed volcanics, amphibolites, hornblende and sericite schists, cut by rhyolites, andesites and quartz porphyries. In a straight line, the railhead on Quinze lake is 45 miles distant from Rouyn township, the center of prospecting activity during the summer and the fall of 1922. There is little doubt that should the new discoveries show signs of permanence and of developing into mines, the C. P. R. line would very soon be extended further north.

UNPROSPECTED AREAS IN QUEBEC

The tract of country where an influx of prospectors is at present taking place, and whence promising gold discoveries are reported is partly in the county of Temiscamingue and partly in the newly erected county of Abitibi. This area appears to hold out great possibilities of gold deposits; but it is very probable that many others exist in the large expanse of pre-cambrian rocks which occupies 90% of the total superficies of the Province of Quebec.

For more than a quarter of a century, geologists and mining engineers have been calling attention to the importance of the pre-cambrian area, and of its rocks, which are the oldest known and which have been widely and intensely subjected to metallogenic agencies. These pre-cambrian rocks which constitute the Laurentian shield, or backbone of the North American continent, outcrop over an area of more than 1,800,000 square miles. Apart from the two small spurs, one of which projects into the state of New York and the other lies to the Southwest of Lake Superior, this development lies wholly in Canada, and occupies over 600,000 square miles in the Province of Quebec. The annual mineral yield of these rocks appears to be proportional to the degree of settlement and of the means of access and communication. In the United States the Lake Superior spur contains the iron mines of Michigan, Wisconsin, and Minnesota, the famous copper deposits of Michigan. In Ontario they are responsible for the nickel deposits of Sudbury, the gold deposits of the Lake of the Woods, the silver mines of Cobalt, the gold mines of Porcupine and Kirkland Lake, whereas in Quebec the mineral resources which they contain are yet lying practically unworked and even undiscovered. Yet many of the richest Ontario mines are comparatively close to the Quebec boundaries, and ore deposition agencies are not trammelled and restrained by political bounds when conditions and associations are identical.

This is being abundantly demonstrated by the recent discoveries which have been made within recent years in the region of the Harricana river, and within the last few months in the district lying to the east of the Ontario-Quebec line, which are creating a stir and rousing quite an interest in Northwestern Quebec.

It is true that the greater proportion of the rocks of the Laurentian Shield are gneisses and granites, which, as a rule, hold out scant promises of return to the prospector, but a study of a geological map will show the presence of numerous areas constituted by outliers of rocks designated as Keewatin, Grenville, Temiscaming, Huronian, Animikie, Keweenawan, which offer promises of results. The presence of such rocks has been observed over an area of forty miles north and south of the National Transcontinental railway, between the Bell river and the Ontario boundary; on the East side of Lake Temiscamingue; at Lake Chibougamau; at Lake Mistassini; on the Eastmain river; on Richmond Gulf; lake Ashuanipi; head waters of the Hamilton river; on Naskaupi river; along the Kaniapiskau and Koksoak rivers, and numerous other places. Some of these are difficult of access, but others are within easy reach.

UNITED STATES TARIFF LEGISLATION

In September 1922, the "New Tariff Act of 1922 on Imports into the United States" came into force, after enactment by the Senate and the House of Representatives, and the following provisions affect the principal products of the Quebec Mineral Industry.

Schedule 1, Par. 16. Calcium Carbide, 1 cent per pound.

Par. 50. Magnesium; Carbonate, precipated, 1½ cent per pound; chloride, anhydrous, 1 cent per pound; chloride, not specially provided for, five-eights of 1 cent per pound; sulphate or Epsom Salts, one-half of 1 cent per pound; oxide or calcined magnesia, medicinal, 3½ cents per pound; oxide or calcined magnesia, not suitable for medicinal use, 3½ cents per pound.

Par. 65. Phosphorus, 8 cents per pound.

Par. 69. Barytes ore, crude or unmanufactured, $4 per ton; ground or otherwise manufactured, $7.50 per ton; precipitated barium sulphate or blanc fixe, 1 cent per pound.

Par. 74. Lead pigments:—Litharge, 2½ cents per pound; orange mineral, 3 cents per pound; red lead, 2¾ cents per pound; white lead 2½ cents per pound; all pigments containing lead, dry or in pulp, or ground in or mixed with oil or water, not specially provided for, 30 per centum ad valorem.

Par. 75. Ochres, siennas, and umbers, crude or not ground, one-eighth of 1 cent per pound; washed or ground, three-eighths of 1 cent per pound; iron oxide and iron hydroxide pigments not specially provided for, 20 per centum ad valorem.

Par. 79. Zinc oxide an leaded zinc oxides containing not more than 25 per centum of lead, in any form of dry powder, 1¾ cents per pound; ground in or mixed with oil or water, 2½ cents per pound; lithopone and other combinations or mixtures of zinc sulphide and barium sulphate, 1¾ cents per pound.

Schedule 2, Paragraph 203. Limestone, (not suitable for use as monumental or building stone), crude or crushed but not pulverized, 5 cents per one hundred pounds; lime not specially provided for, 10 cents per one hundred pounds, including weight of the container; hydrated lime, 12 cents per one hundred pounds including weight of the container.

Par. 204. Crude magnesite, five-sixteenths of 1 cent per pound; caustic calcined magnesite, five-eighths of one cent per pound; dead burned and grain magnesite, not suitable for manufacture into oxychloride cements, twenty-three fortieths of 1 cent per pound.

Par. 207. Clays or earths, unwrought or unmanufactured, including common blue clay and Gress-Almerode glass pot clay, not specially provided for, $1 per ton; china clay or kaolin, $2.50 per ton; solica, crude, not specially provided for, $4.00 per ton.

Par. 208. Mica, unmanufactured, valued at not above 15 cents per pound, 4 cents per pound; valued above 15 cents per pound, 25 per centum ad valorem; mica, cut or trimmed, and mica splittings, 30 per centum ad valorem; mica plates, and built-up

mica, and all manufactures of mica, of which mica is the component material of chief value, 40 per centum ad valorem; ground mica, 20 per centum ad valorem.

Par. 209. Talc, steatite or soapstone, and French chalk crude and unground, one-fourth of 1 cent per pound; ground washed, powdered, (except toilet preparations), 25 per centum ad valorem; cut or sawed, or in blanks, crayons, cubes, disks or other forms, 1 cent per pound.

Par. 213. Graphite or plumbago, crude or refined: Amorphous, 10 per centum ad valorem; crystalline flake, 1½ cents per pound; crystalline lump, chip, or dust, 20 per centum ad valorem.

Par. 232. Marble, breccia, and onyx, in block, rough or squared only, 65 cents per cubic foot; marble, breccia and onyx sawed or dressed, over two inches in thickness, $1 per cubic foot; slabs and paving tiles of marble, breccia or onyx, containing not less than 4 superficial inches, if not more than one inch in thickness, 8 cents per superficial foot; if more than one inch, and not more than one and one-half inches in thickness, 10 cents per superficial foot; if more than one and one-half inches, and not more than two inches in thickness, 13 cents per superficial foot; if rubbed in whole or in part, 3 cents per superficial foot in addition.

Par. 233. Marble, breccia, onyx, alabaster and jet, wholly or partly manufactured into monuments, benches, vases, and other articles, and articles of which these substances or any of them is the component of chief value, 50 per centum ad valorem.

Par. 234. Burrstones, manufactured or bound up into millstones, 15 per centum ad valorem.

Par. 235. Freestone, granite, sandstone, limestone, lava, and all other stone suitable for use as monumental or building stone, except marble, breccia, and onyx, not specially provided for hewn, dressed or polished or otherwise manufactured, 50 per centum ad valorem; unmanufactured or not dressed, hewn or polished, 15 cents per cubic foot.

Par. 236. Grindstone, finished or unfinished, $1.75 per ton.

Schedule 3, Par. 302. Manganese ore or concentrates containing in excess of 30 per centum of metallic manganese, 1 cent per pound on the metallic manganese contained therein; molybdenum ore or concentrates, 35 cents per pound of the metallic molybdenum contained therein; tungsten ore or concentrates, 45 cents per pound on the metallic tungsten contained therein; ferromanganese containing more than 1 per centum carbon, $1\frac{3}{8}$ cents per pound, on the metallic manganese contained therein; manganese-metal, manganese silicon, manganese boron, and ferromanganese and spiegeleisen containing not more than 1 per centum carbon, $1\frac{7}{8}$ cents per pound on the manganese contained therein, and 15 per centum ad valorem; ferromolybdenum, metallic molybdenum, molybdenum powder and all other compounds and alloys of molybdenum, 50 cents per pound on the molybdenum contained therein and 15 per centum ad valorem; ferrosilicon containing 8 per centum or more of silicon and less than 60 per centum, 2 cents per pound of silicon; 60 per cent or more and less than 80 per cent, 3 cents per pound of silicon; 80 or more and less than 90 per cent, 4 cents per pound; 90 per cent or more of silicon, 8 cents per pound of silicon contained; ferrochrome, 3 per cent or more carbon, $3\frac{1}{2}$ cents per pound of chromium contained; ferrochrome, less than 3 per cent carbon 30 per cent ad valorem; ferrophosphorus, ferrotitanium, and all alloys used in manufacture of steel not specially provided for, 25 per centum ad valorem.

Par. 392. Lead bearing ores and mattes of all kinds, $1\frac{1}{2}$ cents per pound of lead contained therein.

Par. 393. Lead bullion, or base bullion, lead in pigs and bars, type metal, Babbitt metal, solder, all alloys and combinations of lead not specially provided for, $2\frac{1}{8}$ cents per pound on the lead contained therein; lead in sheets, pipe, shot, wire, $2\frac{3}{8}$ cents per pound.

Par. 394. Zinc bearing ores of all kinds, containing less than 10 per centum of zinc shall be admitted free of duty; from 10 to 20 per cent zinc, one half of 1 cent per pound of zinc contained; 20 to 25 per cent zinc, 1 cent per pound of zinc contained; 25 per cent or more, $1\frac{1}{2}$ cent per pound of zinc contained.

Par. 395. Zinc in blocks, pigs, slabs, dust, $1\frac{3}{4}$ cents per pound; in sheets, 2 cents per pound.

Schedule 14. Par. 1401. Asbestos, manufactures of:—Yarn and woven fabrics, composed wholly or in chief value of asbestos, 30 per centum ad valorem; all other manufactures composed wholly or in chief value of asbestos, 25 per centum ad valorem.

FREE LIST

Schedule 15.

Chromic acid.

Antimony ore.

Arsenious acid.

Asbestos, unmanufactured, asbestos crudes, fibers, stucco, sand and refuse containing not more than 15 per centum of foreign matter.

Cement, roman, portland and other hydraulic provided that if any country imposes a duty on such cement imported from the United States, an equal duty shall be imposed upon such cement coming into the United States from such country.

Cerite or cerium ore.

Chromite or chrome ore.

Copper ore; regulus of, and black or coarse copper and cement copper, old copper, fit only for remanufacture, copper scale, clippings from new copper and copper in plates, bars, ingots or pigs, not manufactured or specially provided for.

Emery ore and corundum ore, and crude artificial abrasives.

Iron ore, including manganiferous iron ore and residuum from burnt pyrites.

Minerals, crude or not advanced in value or condition by refining, grinding or by other process of manufacture, not specially provided for.

Monazite sand and other thorium ores.

Ores of gold, silver, or nickel; nickel matte; ores of platinum metals; sweepings of gold and silver.

Phosphates, crude and apatite.

Radium and salts, and radioactive substitutes.

Stone and sand: Burrstone in blocks, rough or unmanufactured; quartzite; trap rock; rottenstone, tripoli and sand, crude or unmanufactured; cliffstone, freestone, granite, sandstone, unmanufactured and not suitable for use as monumental or building stone; all foregoing not specially provided for.

Sulphur in any form and sulphur ore, such as pyrites in its natural form, and spent oxide of iron, containing more than 25% of sulphur.

CHEMICAL LABORATORY

The Quebec Bureau of Mines maintains at the Polytechnic School, of the University of Montreal, 228 St. Denis St. Montreal an up-to-date, well equipped laboratory, for the convenience of the interested public. Analyses and assays, determinations of minerals, and tests of various ors, samples, and materials found within the boundaries of the Province of Quebec, are made in this laboratory at prices which are extremely low for the high-grade work done. The laboratory has been established for the sole purpose of aiding the development of the mineral resources of the Province of Quebec. Prospectors and all persons interested in the Quebec mineral resources are cordially invited to avail themselves of the facilities offered. The tariff in force for the analysis and assay of various substances is given further on, and it will be realized that the fees are very low, as the high competence of the chemists ensure results of undoubted reliability.

During the year ending December 31st 1922, the Provincial Laboratory effected 897 analyses, assays and tests, as follows:—

Alumina 11; Antimony 2; Ash 6; Fixed Carbon 6; Calorific power 4; Copper 52; Graphite 29; Gold 284; Ignition 1; Iron 24; Lead 10; Lime 19; Magnesia 17; Manganese 5; Moisture 18; Nickel 7; Phosphorus 3; Platinum 1; Potash 7; Silica 22; Soda 7; Silver 278; Sulphur 12; Tin 1; Titanium 1; Volatile matter 6; Zinc 6; Qualitative tests 58.

Province of Quebec

GOVERNMENT ASSAY LABORATORY

(Under the direction of the Department of Mines of the Province of Quebec as an aid to the development of the mineral resources.)

TARIFF OF FEES FOR ASSAYS AND ANALYSES

DETERMINATIONS	Less than 5 samples Each:	For 5 samples or more Each:
	$ Cts.	$ Cts.
Moisture	0.25	0.25
Combined water	0.50	0.50
Gold and Silver	1.00	0.90
Silica, Copper, Iron — 1 constituent	1.00	0.90
Silica, Copper, Iron — 2 constituents in same sample	1.75	1.50
Iron, in titaniferous ore	2.00	1.80
Graphite, Alumina, Lime, Magnesia, Sulphur, Lead, Nickel, Cobalt — 1 constituent	1.50	1.35
Graphite, Alumina, Lime, Magnesia, Sulphur, Lead, Nickel, Cobalt — 2 constituents in same sample	2.50	2.25
Antimony, Zinc, Manganese, Chromium, Titanium, Arsenic, Phosphorus, Platinum, Bismuth — 1 constituent	2.00	1.80
Antimony, Zinc, Manganese, Chromium, Titanium, Arsenic, Phosphorus, Platinum, Bismuth — 2 constituents in same sample	3.50	3.15
Commercial analysis of an iron ore, comprising determination of silica, iron, phosphorus, titanium and sulphur	6.50	5.85
Commercial analysis of a limestone or cement, comprising: silica, lime, iron, alumina, magnesia, and sulphuric acid	6.00	5.40
Commercial analysis (proximate analysis) of a fuel, comprising: ash, volatile combustible, fixed carbon, moisture	3.00	2.70
Calorific power of a fuel	1.50	1.35
Radioactivity of a mineral	1.00	0.90
Radioactivity of a mineral water	2.00	1.80

DETERMINATION OF MINERALS.—For a nominal fee of 25c. for each sample, the laboratory will make determinations of ores and minerals, provided rapid tests will allow it, and issue a report on probable contents and commercial value of specimens and samples.

TERMS.—Money in payment of fees, by registered letter, postal notes or orders, must invariably accompany the samples, in order to insure prompt return of certificate.

Remittances by money order or accepted chaque, payable at par in Montreal, should be made out to the order of PROVINCIAL ASSAY LABORATORY, not to any individual.

Professor AD. MAILHIOT,
In charge of Laboratory
No. 228, St. Denis St., Montreal.

REPORTS AND RETURNS BY MINE OPERATORS TO THE DEPARTMENT

The Quebec Bureau of Mines, among its functions, collects and compiles the statistics of the mineral production of the Province, and has charge of the inspection of working mines and quarries, from the standpoint of the safety of the workmen. The Department, therefore, has to keep in close touch with the operators of mines and quarries, and the latter are under obligation, by various provisions of the Quebec Mining Law, to give certain notices and make reports to the Department. As some may not be sufficiently familiar with these statutory regulations, we reproduce here various articles of the law dealing with these rules:

Article 2163.—Every owner of mining rights, whether he mines himself or by others, and every person working mines shall, during the first ten days of January in each year, furnish a sworn statement of his operations of the past year, mentioning the quantity of mineral extracted, its value at the mine, the quantity and value of the marketable product, and the number of workmen employed, as well as a list of the names of persons killed in working the mines. R. S. P. Q., 1498; 1 Ed. VII, c. 13, s. 5; 9 Ed. VII, c. 27, s. 12.

Article 2192.—Every person who commences to operate a mine or quarry, or who, after a suspension of six months, resumes operations already begun by himself or by others, is bound, under penalty of a fine of not more than twenty-five dollars, and costs, and, in default of payment, to imprisonment for not more than one month, to give to the Minister a notice in writing setting forth:—

1. The name and address of the person carrying on the operations;

2. The locality and the description of the land on which such operations are carried on;

3. The nature of the ore or mineral, which is the object of the operations. R. S. P. Q., 1528; 55-56 V., c. 20, s. 1; 9 Ed. VII, c. 27, s. 13; 6 Geo. V, c. 19, s. 3.

Article 2213a. If while a mine or quarry is being worked, an accident takes place resulting in loss of life or serious injury, the person working the same or his representatives at such mine or quarry, shall forthwith send a written notice to the Minister, specifying the nature of the accident, the number of persons killed or injured and their names if they are known.

Every person not complying with the requirements of this article, shall be liable to the penalties provided in article 2207.

MINING OPERATIONS IN 1922

ASBESTOS

During the year 1922, the asbestos sold and shipped from Quebec mines, amounted to 160,339 tons, valued at $6,053,068, as compared with 87,475 tons valued at $5,199,789, for 1921. This is an increase of 72,864 tons or 83% in quantity; whereas the increase in price was only $853,280, or 16.7%. The stocks on hand which at the end of 1921 amounted to 53,345 tons valued at $6,764,598, had decreased on December 31st 1922 to 42,201 tons valued at $5,674,584.

The average price of all asbestos shipped during the year was $37.75 per ton against $59.44 in 1921. The very appreciable decrease is ascribable to the lower prices which ruled throughout the year. The industrial depression, which began to be felt at the end of 1920, and prevailed through 1921, was still quite pronounced during the first quarter of 1922. In April, however, a slight improvement was observed and the decline was halted. Conditions have gradually improved since then, but the market prices of asbestos have not increased, although the demand has been much better. It is specially the long fibre qualities which have suffered. In 1920, the crude No. 1 sold at an average of nearly $1,500. a ton; in 1921 this declined to $1,280. and in 1922 to $700. This is still more than double the pre-war prices, and as the lower qualities, such as shingle fibre, paper fibre, and floats, are in good demand the state of the asbestos industry is healthy.

The quantity of asbestos rock mined and hoisted during the year 1922 amounted to 2,920,280 tons, from which was extracted 149,195 tons of fibre, which, valued at the ruling prices of the year, would represent a total value of $4,963,054, or a quantity of 102 lb. of asbestos, valued at $1.70, per ton of rock mined.

The following tables give the detail of the asbestos production during the two years 1922 and 1921:

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC FOR 1922

Shipments and Sales			Average Value per ton	Stock on hand Dec. 31st 1922	
Designation of Grade	Tons	Value		Tons	Value
Crude No. 1	467	$ 302,932	$ 648.68	1,105	$ 694,681
Crude No. 2	1,905	515,442	265.32	3,093	972,036
Spinning Fibre	6,675	1,386,472	207.71	11,505	2,421,724
Shingle Fibre	9,651	781,732	81.00	8,596	717,713
Paper Stocks and others	141,631	3,066,490	21.65	17,902	868,430
Totals	160,339	6,053,068	37.75	42,201	5,674,584
Asbestic	16,011	15,403	0.96		
Totals	176,350	6,068,471			

Quantity of rock mined during the year:—2,920,280 tons.

PRODUCTION OF ASBESTOS IN THE PROVINCE OF QUEBEC FOR 1921

Shipments and Sales			Average Value per ton	Stock on hand Dec. 31st 1921	
Designation of Grade	Tons	Value		Tons	Value
Crude No. 1	184	$ 234,482	$ 1,281.32	857	$ 965,837
Crude No. 2	760	339,649	446.91	2,475	1,710,163
Spinning Fibre	5,372	1,413,318	263.09	7,646	2,124,801
Shingle Fibre	9,650	981,872	101.75	5,324	524,490
Paper Stocks and others	71,509	2,230,468	31.19	37,043	1,439,307
Totals	87,475	5,199,789	59.44	53,345	6,764,598
Asbestic	12,397	14,536	1.17	3	4
Totals	99,872	5,214,325		53,348	6,764,602

Quantity of rock mined during the year:—2,224,138 tons.

Exports of Unmanufactured Canadian Asbestos for twelve months ending December 31st 1922

(From reports of Trade of Canada)
(Dominion Bureau of Statistics)

	TONS	VALUE
United Kingdom	2,473	$ 272,987
United States	139,828	4,516,325
Australia	25	6,000
Belgium	4,853	343,491
France	3,080	282,222
Germany	6,867	779,808
Japan	2,770	159,870
Italy	416	32,566
Netherlands	987	147,499
Other Countries	700	20,025
	161,999	$ 6,555,793

There has been a general tendency and impression to ascribe the slumps in the demand for the Canadian crude fibre to the inroads made by the Rhodesian asbestos, in markets which have, in the past, been exclusively supplied by the Quebec fibre. While there is no doubt that the Shabanie and the Victoria asbestos, from South Rhodesia, are becoming serious competitors of our long fibre asbestos, yet the official figures of shipments of Rhodesian material in 1922 have shown a decrease as compared with 1921, while for the same period the figures of shipments of Quebec long fibre (Crude No. 1, No. 2 and spinning) show considerable increase.

	1920 Tons	1921 Tons	1922 Tons
Quebec long fibre	17,924	6,316	9,047
Rhodesian Asbestos	21,082	21,872	15,958

Royalty on Abestos—On October 21st 1922, an Order-in Council, was passed, with a retroactive effect to January 1922, reducing the royalty on asbestos from 5% on the gross value of the

asbestos shipped, to 2½c. Therefore the new rate applied to all asbestos sold and shipped during the year 1922.

Asbestos Mining in 1922.—Returns of shipments of asbestos were received from 13 producers, who operated 18 mines, during the year:—

Asbestos Corporation of Canada, Ltd., Thetford Mines, P. Q.
Asbestos Mines, Ltd., East Broughton, P. Q.
Bell Asbestos Mines, Thetford Mines, P. Q.
Bennett-Martin Asbestos & Chrome Mines, Ltd., Thetford Mines, P. Q.
Black Lake Asbestos & Chrome Co. Ltd., Black Lake, P. Q.
Canadian Johns-Manville Co. Ltd., Asbestos, P. Q.
Consolidated Asbestos, Limited, Thetford Mines, P. Q.
Federal Asbestos Company, Robertsonville, P. Q.
Guillemette, Donat, Thetford Mines, P. Q.
Johnson's Company, Thetford Mines, P. Q.
Maple Leaf Asbestos Corporation, Ltd, Thetford Mines, P. Q.
Pennington Asbestos Company, Thetford Mines, P. Q.
Quebec Asbestos Corporation, East Broughton, P. Q.

Reports of work done during the year on asbestos prospects or deposits, were received from Louis Croteau, lots 25 and 26, range II, Wolfestown township; Lake Frontier Asbestos Company, lots 8 to 11, range VI, Talon township; Queen Asbestos Co. Ltd., lot 8*b*, range IX, Cleveland township.

The Asbestos Corporation of Canada, operated continuously three of its four mines, viz, the King and the Beaver mines, at Thetford, the British Canadian at Black Lake; the Fraser mine at East Broughton remained idle.

Extensions and improvements were actively carried on at the King mine, without interfering with the production. There are now six large cable-derricks in continuous use, the sixth having been brought in to commission in the early part of the year. The south, or anchorage towers of all these derricks was set back 46 feet, so that the span of the carrying 2½ inch steel cable is now 938 feet between the towers. This has permitted to start mining another slice of rock on the south side of the pit.

The pit opening is now over 900 by 600 feet at the surface, and 345 feet in depth at the lowest point. During the greater part of the year, work was carried on actively on the removal of the overburden on the east side of the pit, so as to extend the workings in that direction. The object is to keep the present width of the pit at 900 feet and to extend it in length from the present 600 feet to 1,200 feet. This means removing the overburden from a surface of 900 by 600 feet. This covering, in places reaches a thickness of 80 feet.

The hydraulic system which had been adopted last year for the removal of the overburden, proved unpractical, and this was changed to a system of steam shovels and cars holding three or four tons.

A new tunnel has been started from the bottom of the pit for the entrance and exit of the workmen. This new passage is horizontal for 200 feet, then slopes up 35° to join the tunnel which has been in use for several years, but the outlet of which is now high up above the bottom of the pit, owing to the deepening of the latter.

Provision is also being made for a large underground sump, where the water from the pit will collect and be pumped up to the surface. The sump will be large enough to collect the drainage of a week, so that pumping could be stopped for six days without interfering with the mining operations.

A new dust settling chamber has been erected on the west side of the mill. By this means, it is said over 80% of the dust which formerly escaped outside and polluted the air, is now collected, bagged and sold. Some five tons per 24 hours is thus collected.

Plans were made for the erection of a complete new mill, to, treat 2,000 tons per 24 hours. Foundations were started in March 1923.

At the *British Canadian* mine, further underground development work was done. The rock is mined almost altogether by glory holes, and is hauled to the mill by tunnel, the portal of which is at a higher level than the crusher bin. There is still one open pit,

however, worked by three small cable-derricks. The mine has not been working at full capacity; during a great part of the year it worked only 4 days a week, but the mill was kept running 6 days, at the rate of 600 tons of rock a day. The capacity of the mill is 1,200 tons per 24 hours.

The *Fraser mine*, which had remainded closed down during the whole of 1921, owing to the sluggish state of the asbestos market, did not resume operations in 1922.

The *Beaver mine* worked four days a week during the greater part of the year. Prospecting tunnelling, to the extent of some 2,500 feet has blocked out a considerable tonnage of good rock to the south of the railway track and a large cable-derrick, similar to the ones at the King mine, has been set upon this part of the Beaver mine. Apart from this large cable-derrick, seven small standard ones are in commission.

The *Bell Asbestos Mines, Inc.*, worked the Bell mine and operated it steadily. All the hoisting of the rock, from the bottom of the pit to the mill, is now done by the incline, which gives great satisfaction. The incline, from the bottom of the pit is 1,330 feet long, of which 940 feet is tunnelling. The average grade is 10%. Hoisting is done in mine cars holding 8 tons each, in trains of four, hauled by a one inch steel cable.

The *Bennett-Martin Asbestos and Chrome Co*, operated both their mines, the Thetford mine and the Vimy Ridge mine.

The former was reopened in June 1922, after having been closed down for 18 months. Beside mining work, a prospecting tunnel was begun, from the bottom of the pit towards the south-west, to test the ground between the Thetford mine and the Beaver mine. Six cable-derricks were working during the greater part of the second half of the year. A change in the method of hoisting is being considered. The cable-derricks would be replaced by an incline.

At *Vimy Ridge mine*, the quarry has been enlarged and there are now four tracks, the one nearest the face is for the loading

cranes, the next for the loaded cars of mill rock, the third for the dump rock, and the fourth for the return of the empty cars.

The main development work of the year at this mine was the driving of two tunnels into the hill, one hundred feet, vertically, below the present floor of the quarry, for prospecting at that level. Satisfactory results are said to have been obtained.

No further work was done on the Edith mine, on lot 28, range IV of Ireland. This is an occurrence of asbestos-bearing rock, which was opened in 1920, and on which considerable work was carried on in 1921, with good results. It is the intention to go on with the development of this mine at an early date.

The *Consolidated Asbestos, Ltd.*, after completely remodelling the mill, and introducing various improvements underground, resumed mining in their Thetford mine in the latter part of June. All the mining is done by large stopes, forty feet wide and measuring between 250 and 400 feet in length. Cars are filled at chutes in the second level, and made up into trains hauled up the main incline. Hoisting is at the rate of 1,500 tons a day, in two shifts.

The *Canadian Johns-Manville Company* worked their Jeffrey mine, at Asbestos, very steadily. Their three mills were working almost to capacity, two shifts a day during a great part of the time. The mine is worked somewhat on the system of the Lake Superior iron mines, that is by benches along which run the tracks for trains to haul away the rock. At the Jeffrey mine the open pit is nearly circular, and the five working benches completely encircle it. After blasting down, the rock is loaded on 20 ton cars by steam shovels, and these cars are made up into trains, which are hauled up along grades of 1½ to 3%, to the three mills, which have a combined capacity of 3,000 tons of rock a day. To save as much blockholing as possible in the mine, a large crushing plant is being erected, of a capacity of 500 tons an hour. The first crushing, to 6 inches pieces, will be done by two Worthington crushers with an opening of 48 inches by 60 inches.

Asbestos Mines, Ltd., is the most north-eastern asbestos prop-

erty now being worked in the Serpentine belt. The mine is situated on lot 13*e* range IV of Broughton township, and the rock is hauled to the mill, 4,000 feet distant, by an aerial tramway. On December 10th 1922, the mill, the storage shed, the tailing conveyor, the rock conveyor and the mill bin were completely destroyed by fire, causing a loss estimated at some $200,000. Without any loss of time, rebuilding was commenced immediately. The mill of the Windsor Asbestos Company, which had been erected at Coleraine, but had only been used for trial runs, was purchased and transported to East Broughton. Four months after the fire the new mill was in commission.

The *Quebec Asbestos Corporation,* carried on all their mining work in Pit No. 1, that is the old Ling mine on lot 13*b* of range IV. Mine No. 2, the old Eastern Townships Co's pit, immediately south west of mine No. 1, remained closed all the year. This property was acquired by the Quebec Asbestos Corporation in 1920, and it was worked in 1921. It is the intention to resume mining at No. 2 mine, early in the spring of 1923.

The *Windsor Asbestos Company,* at Coleraine, went into liquidation in December 1921. During the summer of 1922 some test drilling was carried on, on behalf of the share-holders, to the extent of a few hundred dollars, and in December 1922, the mill was dismantled and transported to East Broughton on the site of the mill of the Asbestos Mines, Limited, which had been destroyed by fire early in December.

In March 1922, a fire destroyed part of the Asbestos Brake Lining Co's manufacture, which was operated by Mr. Joseph Poulin.

Asbestos in Other Countries

United States.—No figures of production of asbestos in the United States have yet been published covering 1922, but from information at hand very little activity prevailed in any of the United States asbestos fields, and the production figures, when rendered public will be insignificant. During practically the whole of 1922 the Arizona mines remained idle, and very little of note is reported from the California mines.

In 1921, the total production of asbestos from United States mines was 831 short tons valued at $336,968 according to U. S. Geological Survey. Of this, 438 tons valued at $313,268 were chrysotile, and 393 tons, $23,700 were amphibole. Arizona's contribution to the production was 413 tons of chrysotile, valued at $311,768.

Rhodesia.—From the figures of the Rhodesia Chamber of Mines the production, or rather the exports, of Rhodesian asbestos during the year 1922 amounted to 14,249 long tons as compared with 19,529 tons in 1921, a decrease of 27% in quantity. The values are rather difficult to arrive at accurately, owing to "adjustments on sales" which are made at irregular intervals and which may bear partly on the current year and partly on the preceding year, but the 1921 production had an approximate value of £600,000 and the 1922 production represented about £400,000.

In January 1923, the ruling prices in London for South Rhodesian white asbestos were as follows:—

$\frac{3}{8}$ to $\frac{1}{2}$ inch £25 per ton; $\frac{1}{2}$ to $\frac{3}{4}$ in. £45; $\frac{3}{4}$ to $1\frac{1}{4}$ in. £75; $1\frac{1}{4}$ to 2 in. £100, the market being steady but dull.

Union of South Africa.—Figures for the 1922 production of asbestos of the Union of South Africa are not yet available, but the 1921 production was as follows, according to the Annual Report of the Department of Mines and Industries of the Union:

Province	*Tons*	*Value*
	2,000 lb.	£
Cape	3,467	74,499
Transvaal	1,543	27,546
Natal	62	1,032
Totals for 1921	5,122	£103,067

The Cape production consists altogether of Blue asbestos (crocidolite); the Transvaal production is amosite and chrysotile; the Natal production is partly chrysotile and partly tremolite.

The prices ruling in January 1923 in London for Cape asbestos were as follows:—

Blue A. $\frac{3}{8}$ to $\frac{3}{4}$ inches £20; Blue B. $\frac{3}{4}$ to $1\frac{1}{4}$ £35; Blue C. $1\frac{1}{4}$ to 2 in. £45; Blue D. 2 in. and over £45 to £50. The market and demand were firm for fibre of $\frac{3}{4}$ inches and upward but very slow for the shorter qualities.

Russia.—According to "U. S. Commerce Reports" (Sept 1922) published by the Department of Commerce, quoting "Economic Life" the official Moscow Soviet daily, the exports of asbestos from Russia during the year 1921 amounted to 206,900 poods equal to 3,737 tons. The pre-war production varied between 10,000 and 15,000 tons.

(1) "Practically all of the Ural production came from Baskenovo, in the Government of Perm. Baskenovo (60 miles northwest of Ekaterinburg) lies in a belt which contains a number of masses of serpentine, the belt being approximately 18 miles long and from 2 to 3 miles wide. The asbestos-bearing portions of the serpentine are elliptical in form, the largest being 3,500 ft. long and 1,000 ft. wide. Asbestos occurs as cross-fibre in a stockwork of veinlets the cantral portion of the ellipse as a rule being the richest in asbestos. The maximum width of the veinlets is 8 in.; a little slip-fibre is also present. The fibre is high grade, although less suitable for spinning than the Canadian. The deposits were found by a farmer in 1710, and Nikita Demidov, the founder of the famous mining family of that name, began mining soon thereafter. Various textiles were woven of the material for the next fifty or sixty years, but the demand was small and the industry languished. The open cuts were reopened on a small scale in 1883, and since 1889 the industry has prospered.

"Mining is done in open pits largely by contract miners who spend most of their time farming. In consequence of this and a severe winter climate mining is confined largely to the months of May, June, September, and October."

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(1) Sydney H. Ball.-Eng. & Ming. Journal, Dec. 2nd, 1922.

CHROMITE

Chromite mining in the Coleraine district was at a standstill all year, none of the mines having reopened in 1922. One shipment of 767 tons, valued at $11,503 was made from stocks on hand, and this constituted the only activity in the chromite industry.

However, there was a beginning of resumption of work in January 1923. A new concern, organized by Messrs. Poudrier and Larochelle, of Black Lake, took a lease on the mine and mill of the J. V. Bélanger Company, one of the best properties of the district, and have put men on reopening the mine and preparing the mill to start producing.

The chromite industry of the Province of Quebec is handicapped from the fact that all our deposits are pockety and irregular; the ore must be treated by concentration to obtain chromite carrying the 45 to 50% chromic sesquioxide required by the market, whereas Rhodesian, New Caledonian and Indian chromite are shipped as mined, in lumps. The average price of chromite at 50% $Cr_2 O_3$, at United States Atlantic ports, c. i. f., was in the vicinity of $22

During 1922 Rhodesia exported 93,474 long tons of chromite, as compared with 50,188 tons in 1921. The mines were not working at their full capacity during 1922, and they would be able to considerably increase their output should the demand increase. It is interesting to note that although the supply from Turkey and Russia, which before the war were important producers, has stopped altogether owing to the disturbed economic conditions prevailing in these two countries, this shortage has been more than filled by Baluchistan, which is now yielding a large output owing to the railroad construction in 1917. Much of the Baluchistan ore, which contains 50 to 53% $Cr_2 O_3$ and is low in silica, is reported to be marketed in Germany. (1)

COPPER.

All the copper mines of the Province of Quebec were idle during the whole of 1922, and very little work was done on any of the prospects.

No mining nor shipments of ore were effected at the Eustis

(1) Edward Sampson, Eng. and Mining Journal, January 20th, 1923.

mine, which has been closed down since April 1919. The mine is kept pumped out, and work could be resumed at very short notice.

At the McDonald mine, the owners, the *Weedon Mining Company, Ltd.* have apparently given up the hope of resuming work in a near future, for after stopping mining work in May 1920, the mine was kept in good order, and pumped out until October 1922, when pumping was stopped and pumps removed. It is now flooded.

The *Quebec Megantic Copper Co.*, which had been organized in 1921 to develop and work a copper deposit on lot 8, range I (Cadastral No. 14), of Inverness township, carried on development work

The deposit was visited by an officer of the Department in July. At the time, there were three excavations opened on apparently two mineralized zones. Pit No. 1 is 100 feet south of No. 2, and No. 3 is 25 feet north of No. 2. Shaft No. 1 is 20 feet deep and is timbered. No. 2 was an incline, 35 feet deep, with a timber head-frame 40 feet high. It is reported that sinking of the latter was carried down to a depth of 100 feet.

Apparently the operations did not meet with the expected success, for the company went into liquidation in January 1923, and a sheriff sale of the property was advertized to take place on February 7th 1923.

An interesting group of claims, staked out for copper in 1921, in the region of the headwaters of the York river, in Gaspé, was visited during the summer by an officer of the Bureau of Mines.

These claims are situated at the very head of one of the branches of the York river, almost directly south of Mont-Louis, just beyond the watershed between the Magdalen and the York rivers, and they may be reached either by Mont-Louis, or from the east by following up the York river from its mouth to its head.

The attention of prospectors was attracted to this area by the floats in the beds of the brooks. Numerous pebbles and angular blocks coloured a vivid green by carbonates of copper, are encountered in all the beds of the streams.

The country is very hilly, broken, timbered and soil covered, except on steep hillsides and cliffs. Outcrops of solid rock are few in the lower levels, but the nature of the underlying rock can usually be ascertained by uprooted trees. The highest point reached on the claims in the course of the examination was 855 feet above the brook, or 2,675 feet above sea level.

The prevailing rocks, which constitute the various hills comprised by the group of claims, are essentially volcanic tuffs, light coloured and very quartzose, cut by typical granite porphyries, with large, easily visible phenocrysts of quartz, feldspar and mica. This association of rocks constitutes a combination favourable to the formation of ore deposits, if the mineralizing agents happen to have been active and to have had easy circulation. There is no doubt as to the size of the massif of igneous rocks. Rock specimens were taken from outcrops on the claims W. Miller, Fred Miller, A. E. Miller, S. Viet, Jos. Miller, John Baker, Alvah Miller, at various spots, and everywhere the rocks are volcanic tuffs, porphyries, dark trap rock, granites, in order of importance, showing igneous rocks over an area at least three miles long north and south, by one and a half miles wide. In all probabilities, the area occupied by these rocks is many times greater.

Up to the time of my visit, in mid-August 1922, the trenching and stripping work had been limited to two claims, Fred. A. Miller's and Alf. Miller's.

These two claims occupy, in part, the western slope of a range of hills, which reaches its highest point, 2,480 feet above sea, on Alf. E. Miller's claim. The comparatively steep slope is mostly bare of vegetation and is covered with a thickness, up to three or four feet, of loose angular rock, detached and broken up in blocks up to 50 lb. or more, from the solid underlying rock and forming a surface, on the hillside, which looks like a series of rock slides and talus, measuring some 400 to 500 feet long by 150 to 200 wide on Fred. Miller's claim, and double that area on A. E. Miller's. The rocks are volcanic tuffs and porphyries, stained green in many places.

On Fred. Miller's claim, a trench some 100 feet in length has been excavated to the solid rock at an elevation of some 200 feet above the brook. This trench shows several narrow zones stained green by carbonates. In the center is the widest seam of carbonate ore which is very nearly four feet wide, and is practically vertical. Sample 1 is selected ore from this vein. Sample 2 is an average of the four feet of the vein. Sample 3 is an average of the 90 to 100 feet of the trench, as represented by grab samples from the dump along the trench, taken every foot or so. This trench shows green stains in the walls right along its whole length, but the average

copper contents would be low. Another trench was being dug on the same claim, 250 feet to the north of the main trench, some 40 to 50 feet higher up the slope of the hill. This trench, 30 feet long, shows narrow veins of quartz, carrying carbonates and unaltered chalcopyrite. The average contents of copper showing in the treach walls would be low. (See p. 37)

On Alf. E. Miller's claim the work has been limited to a few prospecting pits which show green colorations and specks of chalcopyrite ore.

The presence of this chalcopyrite, on these two claims, accompanied by the green coloration of the carbonates, would seem to indicate that the present surface is near the top of the secondary sulphide zone, the upper, or oxidized zone having been removed or eroded away.

Emmons, in *Principles of Economic Geology* states that "Most "of the large copper sulphides deposits in the United States, show "three zones, (1) a leached zone near the surface, (2) an enriched "zone below the leached zone and (3) a zone of lower grade primary "ore below the enriched zone. In some deposits, the oxidized ores, "and in some the primary sulphide ores, are rich enough to work. "In other deposits only the ores of the secondary sulphide zone are "profitable."

In conclusion, it may be said, from the short time spent on the claims, (2½ days), that the geological conditions, as to the nature of the rocks which are porphyries and volcanic tuffs, are eminently favourable to the possibility of the presence of deposits of copper of workable size. The small amount of trenching and stripping which has been done is entirely inadequate to enable to form an opinion other than conjectural. But the district is worthy of geological investigation and prospecting on a large scale. Large sums of money may have to be spent before finally deciding whether or not the present indications would turn into workable bodies.

The results obtained by the analyses of the samples are rather encouraging, but there are serious adverse features. Prospecting in the region is very costly, as supplies have to be packed in by foot-trail. Development work would, of course, also be very expensive, as at present the only trail into the district, is by the valley of the York river, a distance of more than 50 miles. A shorter way in could easily be cut from Mont-Louis. The means of trans-

portation, from the standpoint of mining and production, are absolutely lacking, and the region is very difficult for railway construction. Gaspé, the nearest railhead, is forty miles distant in a straight line. Mont-Louis, the nearest tide-water, is twenty miles in an air line, with a rise of over 2,000 feet to reach the watershed of the York river. So that, while the district certainly offers possibilities as to copper deposits, it can only be considered at present as constituting latent resources for the future, unless some phenomenally rich discoveries should be made. Such an event could only follow from intensive prospecting and development which would be very costly under the present conditions, and could only be undertaken by a strong financial organization. The absence of precious metals is also a feature which would militate against an early exploitation of the deposits, for judging from the analyses, which follow, copper would be the only metal to be recovered from the ore.

ANALYSES OF SAMPLES FROM MILLER CLAIMS

No. 1.—*Selected ore from small ore dump.*

Copper	9.80%
Gold	none
Silver	none

No. 2.—*Average ore from 40 inch vein in trench.*

Copper	3.80
Gold	traces
Silver	traces

No. 3.—*Average of dump on side of trench.*

Copper	1.95
Gold	trace
Silver	trace

LEAD AND ZINC

There was no production whatever of lead and zinc ores in 1922. The mines at Notre-Dame des Anges in Portneuf county, which were formerly operated by the Zinc Company, Limited, closed down in April 1921 and remained idle during the whole of

1922. In 1921, this mine was operated during the first three months of the year only, during which 15,500 tons of ore were treated in the mill, but of the resulting concentrates only 778 tons of galena was shipped, the zinc concentrates apparently not having been disposed of.

This mine was operated by the *Zinc Company, Limited*, in virtue of a lease which expired in 1921, and was not renewed. It then reverted back to the Pierre Tétreault Estate, 4300 Notre Dame St. East, Montreal, who have not gone on with operations, except keeping the mine pumped out. During the whole of 1922, pumping was the only work carried on.

The *Federal Zinc and Lead Company Ltd.*, did not do much underground development work in their Lemieux township mine. All their efforts were concentrated on the road construction between the mine and the main road, which follows the Grand Cascapédia river.

The year was more favourable to the production of lead than to the zinc industry, for the price of lead in New York rose from $4.70 in January to $7.16 in December 1922, whereas zinc increased from $4.69 to $7.00 in the same period. But towards the end of the year the zinc market was fast recovering, and the future of the lead and zinc industry is much brighter at the beginning of 1923, than it was at the beginning of 1922.

During the field-season of 1921, Dr. F. J. Alcock, of the Geological Survey, worked out the geology of the township of Lemieux, in Gaspé county, with special reference to the lead and zinc deposits. The preliminary report of his work was published in Part "D" of the Summary report of the Geological Survey for 1921. It comprises 26 pages of text and two geological maps, which will prove most useful and interesting to anyone interested in this region. We are reproducing some of his conclusions here below.

Extracts from
Geology of Lemieux Township, Gaspe County, Quebec (1)

The area comprises approximately 70 square miles and lies in the central part of Gaspé Peninsula on the divide between the

(1) Dr. F. J. Alcock, Summary report, Geological Survey, for the year 1921, Part D, pages 71-96.

waters flowing about 25 miles (as the crow flies) north to the St. Lawrence and those flowing south about 40 miles (as the crow flies) to Chaleurs Bay. The area, though nearer the St. Lawrence, is more easily reached from the south, by which route Shickshock mountains are avoided.

The following is a generalized summary of the rock succession in Gaspé peninsula:—

Devono-Carboniferous	Bonaventure series.
	Unconformity.
Middle Devonian	Gaspé sandstone.
	Unconformity.
Lower Devonian	Gaspé limestones.
Silurian	Mont-Joli massive. Black Cape Section, etc
	Unconformity.
Ordovician	Quebec group.
	Unconformity.
Precambrian	Metamorphosed sediments and igneous rocks.

Palaeozoic igneous rocks; acid and basic lava flows; acid and basic sheets and dykes; peridotites, largely serpentinized; deep-seated acid intrusives.

The consolidated rocks of the map-area consist of sediments, volcanics, and intrusive rocks of both hypabyssal and deep-seated varieties. The following is the succession:—

Porphyry, granite, syenite.
Intrusive contact.
Gaspé sandstone.
Basic and acid volcanics.
Shales and limestones.

ECONOMIC GEOLOGY

Lead-Zinc

Crown-granted mineral claims of the area (Map 1935) are held by two companies, the Federal Zinc and Lead Company and the

North America Mining Company. Almost all the exploration and development work has been carried out by the former company. The president of the Federal Company is Mr. T. O. Lyall; the vice-president and general manager is Mr. J. C. Beidelman; the company's headquarters are at 285 Beaver Hall Hill, Montreal.

Character of the Deposits.—The deposits are in Devonian shales and limestones intruded by porphyry and syenite. The sediments are folded, faulted, joined, and brecciated. There has also been movement after the period of mineralization.

The country is covered by a heavy overburden and in consequence outcrops are few. The presence of ore is usually detected by finding pieces of galena in the float. These sometimes form large rounded masses, weathered brownish; as a rule they have not travelled far, and by trenching uphill from such float, vein outcrops can usually be uncovered. In other cases actual outcrops of veins are exposed. Most of these outcrops consist of chambered quartz from which the zinc blende, and often also the galena, has been leached. The quartz is white or perhaps stained brownish; the amethystine variety, common underground, is usually bleached white in the surface exposures.

In the form the deposits are veins, and like most veins they pinch and swell. In some places they show sharp contacts with the enclosing rock, in other places there is a brecciated zone in which there is a more or less gradual transition from massive vein material to barren country rock. In places the latter type becomes a stockworks. Horses of country rock of various sizes and shapes are found in the veins and have sharply defined borders and angles, showing that the solution which deposited the vein material did not affect the shales.

The dip of the veins is for the most part over 70 degrees. The larger veins run in a general north-east direction, cutting across the strike of the sediments. They apparently follow fault and brecciation planes, with mineralization to a lesser extent along joint planes. In addition there has been movement later than the mineralization. One fault parallels the west wall of the Federal vein, and 180 feet north of the north crosscut, the same vein is cut off on the 100-foot level by another fault.

Mineralogy of deposits.—The minerals of the veins are sphalerite and galena in a gangue of quartz and carbonate. Pyrite, mar-

casite, and chalcopyrite are present in very minor amounts. The sphalerite is for the most part light yellow, varying locally, however, to a reddish brown, and is almost free from iron. It compares favourably with the best Missouri blende.

An analysis (made by J. T. Donald and Company, Montreal, for the Federal Zinc and Lead Company) of a sample of ore gave the following results:

	Per cent
Insoluble and silica	0.35
Iron oxide	0.82
Alumina	0.10
Sulphur	32.46
Zinc	66.00
Lead	traces
Lime	None detected
Magnesia	None detected
Cadmium	None detected

In the surface exposures and to a certain extent in the upper parts of the veins the sphalerite has been leached out by surface waters, but the leaching has affected only slightly the amount of zinc blende originally present. Some of the surface specimens have a white coating which consists of an intimate mixture of zinc hydrated carbonate or hydro-zincite. A soft, white kaolin mineral is also found on the 100-foot level, and even on the 250-foot level, but only in small amounts.

On the 250-foot level a greenish yellow mineral is associated with the zinc ore both in the veins and in the breccia. This mineral was found to be an hydrated silicate of aluminium carrying a smaller quantity of magnesium. The ratios of silica to aluminium and magnesium are as follows: for 12 Si there are 8 Al and 1 Mg; the water ratio was not determined. The mineral when examined under the microscope was seen to consist of low birefringent fibres. The mean index of refraction is 1.566. It does not possess physical and chemical characters sufficiently well defined to place it in the mineralogical nomenclature. It is certainly a mineral of the kaolinite group carrying in addition a small quantity of magnesia.

The galena is less abundant than the sphalerite, but there are places where it occurs in large masses. Being less soluble than the sphalerite, it persists in the upper part of the vein; and in some of

the outcrops it occurs in the quartz, often with a reddish brown coating of iron oxide. The cleavage surfaces range from minute areas to surfaces over 2 inches across. In one vug lined with small crystals of dolomite an excellent galena crystal showing cube faces truncated by octahedron corners was found. Some of the larger masses of galena show strain effects, produced by movement after the periods of mineralization.

The chief gangue mineral is quartz, both white and amethystine. In places the quartz is definitely banded, and frequently there is a comb structure. At one place in the Federal vein there are six of the parallel fillings which show that at the least six times the vein was closed and reopened along the wall. The banded veins which show this comb structure in the centre almost always consist of amethystine quartz. In some places the central bands consist of amethystine quartz, and the outer part of white quartz. Dolomite occurs as minor gangue mineral and a light yellow carbonate of the composition of ankerite is also fairly abundant.

On the 250-foot level are numerous small stringers of light pink calcite. Most of these are less than an inch in width and as a rule cross the bedding of the shales at steep angles.

A study of some polished sections of the ore brought out some facts with regard to its paragenesis. A specimen composed largely of dark sphalerite was found to contain the iron sulphides, pyrite and marcasite, of which marcasite was the younger. The latest sulphide introduced was galena which occurs as veins traversing the other sulphides; its deposition was probably in the nature of a replacement. Though essentially belonging to one period of mineralization, there seems to have been a certain order of deposition among the vein minerals, but, undoubtedly, the periods of deposition of all the minerals overlapped. The first period was largely occupied by the deposition of quartz. Then followed iron and zinc sulphides of which marcasite was the latest. Later still came solutions which deposited lead, and, last of all, quartz and carbonate.

Origin of the Deposits.—The deposits are believed to be genetically related to the deep-seated intrusive rocks of the area. Siliceous sulphide-bearing solutions from the magma in the later stages of its crystallization probably travelled along lines of fractures for considerable distances from their source and deposited their sul-

phide and silica content along these fracture planes and in brecciated zones. The shales were the most influential in causing precipitation from solution. Earth movement continued during this period of mineralization. The veins were repeatedly reopened and even after vein deposition ceased, further faulting took place.

Development.—Sixteen veins have been exposed by surface workings. Only the main ones have been shown on the map of the region around the mine. All of these show ore where they have been opened. The main vein, and the best developed, is the Federal or No. 1. It has a known length of approximately 600 feet and an average width of 8 feet. In places it is considerably wider than this and in addition is bordered locally by mineralized breccia. Several other veins intersect it. With more development it may be found that other veins compare favourably, in size and quality with the Federal. Two of these possibilities require mention. The first is the McKinlay, or No. 16, which forms a large, abrupt outcrop on Federal hill 900 feet southwest of No. 1 shaft. This is a large vein whose length has not as yet been determined by trenching, but which is exposed in the road to the East of the main outcrop. It has a width of 60 feet which includes, however, a horse of country rock. The vein contains high-grade ore, and is bordered on the north by breccia. The other possibility is No. 14, or the Bois. It has been traced by trenches and sunk on for 64 feet. The vein has a maximum width of 18 feet and shows the usual mineralization, with the local addition, however, of more chalcopyrite than is at present in the Federal vein

Most of the exploration has been carried out from No. 1 shaft on the Federal vein. This was originally sunk 100 feet on an incline following the vein, but later, a vertical shaft was sunk from the surface to a depth of 257 feet. The amount of horizontal workings from this shaft is as follows:

Drifting	*Feet*
North drift (100-ft. level)	657..3
Drift from No. 1 west crosscut, north (100-feet level)	34..2
South drift (No. 1 level)	360..8
Drift around Federal shaft (100-ft. level)	73..8
	1,126.1

Crosscutting:

No. 1 west crodscut north (100-ft. level)	180..4
No. 2 " " north " " "	164..0
No. 1 east " north " " "	30..9
No. 1 west " south " " "	48 0
Adit 100-ft. level	126 8
Adit 250-ft. level	104..0
West crosscut 250-ft. level	165. 0
East crosscut 250-ft. level	61..0
	880..1

The Gilker or No. 2 shaft has been sunk to a depth of 18 feet, and the Bois or No. 3 shaft to a depth of 64 feet.

The rock at the portal of the 100-foot level consists of shales, in beds of from 2 to 4 inches thick striking north 75 degrees west and dipping 55 degrees southwest. The rock is finely jointed and traversed by small quartz stringers along the jointing and bedding planes. About 75 feet from the portal a breccia zone 12 feet wide contains a net work of stringers with some masses of yellow zinc blende. From this point to within 20 feet of the south drift, the shales are poor. This last 20 feet, however, consists of breccia with some sphalerite.

The south drift follows a vein the foot-wall of which is sharply defined but whose eastern border fades out into brecciated shales. The vein as exposed here is from 5 to 8 feet wide and consists of quartz and carbonate with sphalerite and galena, and numerous small horses of shale with a part of the vein in the foot-wall. The foot-wall follows a post-mineralization fault-plane marked by a zone of crushed shale which varies up to 6 inches in width. The short south crosscut exposes heavily-bedded dark shales. A little one is exposed at one place in the face, but there is no definite vein. Two parallel light-coloured zones of soft meterial, ½ to 6 inches in width, which follow the bedding planes and which are evidently minor shear zones, occur in this crosscut.

The drift, north of its junction with the adit, cuts through vein and mineralized breccia material. In places the vein carries a series of parallel bands of amethystine quartz showing a succession of reopenings and closings. A large horse of shale 10 feet long and

2½ feet high is present in the mineral zone. Immediately south of the shaft the vein is from 12 to 16 feet wide.

At the north crosscut the fault plane which borders the south drift is well marked; 1½ feet to the west of it another fault is seen parallel to it. At 65 feet along crosscut is still a third fault which runs at right angles to the crosscut. The north crosscut traverses shale in beds from 1 to 6 inches in thickness and contains a few stringers of vein material. A short drift from the north crosscut follows a vein 5 feet to 6 feet wide which is probably the underground extension of No. 3 vein, and carries high percentages of ore.

North of the shaft the main drift follows the Federal vein which here shows quartz and ore up to 12 feet in width bordered by a zone of mineralized breccia. At 180 feet north of north crosscut No. 1 the vein is cut off by a fault plane dipping at an angle of 50 degrees to the east. The fault plane is an open fissure and strikes north 45 degrees west.

North of this fault the north drift follows a vein known as the porphyry, from the fact that it parallels a band of light coloured rock, though throughout its exposed length there is a band of black shale 1 to 3 feet wide between the vein and the light grey rock. This rock, which is approximately 50 per cent carbonate, is apparently a porphyry intrusion, highly altered by carbonate solutions. In places it contains disseminated masses of zinc blende. The vein has a width of from 1½ to 6 feet, is bordered by breccia, and has been followed for 200 feet. It contains rich zinc and lead values. South of the turn in the drift, the vein disappears, but, 35 feet east of the bend, a vein 3 feet wide, a continuation of the Porphyry vein, crosses the drift. From here to the breast of the drift the walls show nothing but shale striking north 67 degrees east and dipping 27 degrees southeast.

North crosscut No. 2 is driven through shales and dense, dark-coulored crinoidal limestones for 55 feet and then passes into porphyritic syenite. This rock is fresh and massive, but shows local slickensided fractures and small quartz stringers. North crosscut No. 3 exposes only shales.

On the 250-foot level, a total length of 226 feet of crosscutting has been done. East of the shaft the rocks exposed consist of shales and limestones. These rocks are interbedded, but in places irregular masses of limestones are surrounded by shale, a condition

brought about by the deformation of the beds. Near the east end of the crosscut some rich ore has been exposed. On the north side is a vein zone 4 to 5 feet wide containing zinc blende and galena in large masses and bordered by a broad breccia zone. Directly opposite, on the south side, is a rich zone 12 feet wide. A fault plane appears on the roof of the crosscut on the north face and cuts the south face about 2 feet above the floor of the crosscut. The fault is parallel to the bedding of the shales. Either two veins have been brought together at this point or there has been faulting across a vein bringing a wider part over a narrower part. The fault plane shows a marked gouge zone and slickensided striations.

West of the shaft the crosscut shows a number of features of interest. Ten feet from the shaft is a brecciated vein zone containing ore. Fifteen feet farther on is a fault plane dipping 20 degrees to the east which is open in places and forms a water course. Several other faults are exposed in this crosscut, and a few small veins with accompanying breccia zones. Numerous veinlets of pale pink calcite here cut the shales.

Ore values.—The veins exposed throughout the workings show good values in zinc and lead ore and even the brecciated zones are in places rich enough to be mined. The following is a list of assays from samples cut across the quartz veins at various points and across some of the brecciated zones. The samples were taken by Dr. Walter Harvey Weed and are given here through the courtesy of the Federal Zinc and Lead Company.

SAMPLES

No.	LOCATION	*Thickness Feet*	*Lead %*	*Zink %*
1	Between tunnel and south drift	12.0		
2	Quartz-spar vein next to wall opposite south drift	8.4	2.8	8.2
3	Breccia, east of No. 2	9.5	0.0	1.0
4	Across vein north end south drift	6.3	3.1	11.1
5	South face, end south drift	6.5	14.1	5.8
6	Vein, at 61 feet south of inclined shaft, foot-wall	6.0	6.6	4.4
7	Vein at 61 feet south of inclined shaft, hanging wall	5.4	3.4	3.9
8	Point 20 feet north of No. 7, 41 feet from shaft, hanging wall	6.0	0.9	3.6
9	Point 20 feet north of No. 7, 41 feet from shaft, hanging wall	6.0	0.9	6.8
10	At first crosscut northwest of shaft	8.2	1.5	3.2
11	30 feet north of No. 10	6.0	2.5	15.3
12	22 feet north of No. 11	6.0	3.0	8.3
13	30 feet north of No. 12	4.8	2.2	8.4
14	16-2 feet south of Survey Hub No. 8, 20 feet north of 13	3.5	9.5	15.3
15	12 feet north of Survey Hub No. 8	6.0	9.2	8.3
16	46 feet north of Hub No. 8	6.0	1.2	5.7
17	Crosscut to east breccia at end of east crosscut	10.0	0.0	3.9
18	Breccia west of 17	10.0	0.0	trace
19	Across vein over porphyry in crosscut west for 10 feet from drift	7.5	0.0	3.3
20	Breccia corner of east crosscut north side to drift and to No. 18	4.3	0.0	1.1
21	35 feet from east crosscut	4.0	0.2	2.7
22	12-6 feet beyond No. 21 opposite fault.	10.0	2.3	8.2

"A composite sample representing equal parts of material from twelve cuts across the Federal vein from the extreme south end to the northernmost point exposed shows 3.8 per cent lead and 7.9 per cent zinc with 9.46 per cent lime and 43.85 per cent silica. This composite sample is considered as representative since it checked up closely with the calculated average of the individual assays and it may be accepted as an average for the entire vein so far as exposed underground."

The assays show that the lead content of the veins and brecciated zones varies from nothing up to 14 per cent and the zinc up to 15 per cent.

Conclusions regarding Deposits.—The development which has been carried out so far indicates that there is a large quantity of ore in sight. With regard to the persistence of the veins in depth, vein outcrops have been found throughout a vertical range of 560 feet, this being the difference in elevation between a vein, exposed in a cut for a road in the valley bottom, and that of the outcrops on the summit of the Federal hill. It is probable that such strong veins as the Federal, the Porphyry, the McKinlay, and others extend to much deeper than this. It is commonly assumed that a vein is as deep as it is long; hence a depth of 1,000 feet or even considerably more is quite to be expected. Should this prove to be the case the Federal would have an available tonnage that would make this one of the large zinc properties of America. The ore is of excellent quality, is in no way complex, and should be easy of concentration. The handicap at present to further development is lack of good means of communication.

Other Prospects

The North America Mining Company holds the mining rights on claim L and several other claims of the area. On claim L a shaft has been sunk 30 feet and two open-cuts have been made. The veins opened up are similar in character and mineralization to those on the Federal Company's holdings, but so little work has been done that it is impossible to make any statement with regard to their possibilities.

The surrounding region deserves to be still prospected. In addition to the zinc and lead deposits, chalcopyrite has been found in several of the veins of the region which suggests the possibility of copper deposits being located. The contacts of the Tabletop batholith with the Palaeozoic sediments should also be searched for ore deposits. The serpentine belt likewise deserves to be thoroughly prospected. Chromite is known to be present in small quantities and it is possible that deposits of commercial importance may yet be found. Similar basic rocks in other parts of the world are also the source of platinum.

GOLD AND SILVER

For a number of years past the small quantity of precious metals produced annually in the Province of Quebec, have been by-

products derived incidentally from the treatment of the copper, lead and zinc ores, and as none of these ores were produced or shipped in 1922, there has been no production of gold and silver to record this year.

There is at present no gold industry, properly speaking, in the Province of Quebec; that is production of gold from quartz vein mining, or from placer deposits, although the province possesses both kinds of deposits.

The gold placer deposits of the Beauce district, in the basin of the Chaudière river, have been known since 1823, and for many years were the object of active operations, more particularly between 1870 and 1885. The total value of the gold extracted from these deposits, from the beginning of operations up to 1912, when the *Compagnie des Champs d'Or Rigaud-Vaudreuil* discontinued work, has been estimated at between 2½ and 3 million dollars. A detailed report on the geology of the "Beauceville Map-Area", by Dr. B. R. Mackay, was published in 1921, by the Geological Survey, Department of Mines, Ottawa, and to this valuable report, anyone interested in the placer deposits of the Chaudière basin is referred. Gold bearing sands have also been observed in several other places in the Province.

The presence of gold bearing quartz veins has been noted in various places, but within the last year the areas which have been most prominently before the public, and have attracted the attention of prospectors, are situated in northwestern Quebec, south of the Transcontinental Railway, east of the interprovincial boundary, between Quebec and Ontario. The geological conditions in this region are very similar to those prevailing in the Larder Lake, Kirkland Lake and Porcupine districts, and a considerable rush of prospectors, accompanied by an active staking of mining claims, started in the spring of 1921, and after one year does not show signs of abating.

The main scene of activity comprises the townships of Dasserat, Boischatel, Rouyn, Joannès, Dufay, Dufresnoy, and Montbray which are in part in Temiscamingue county and in part in Abitibi county.

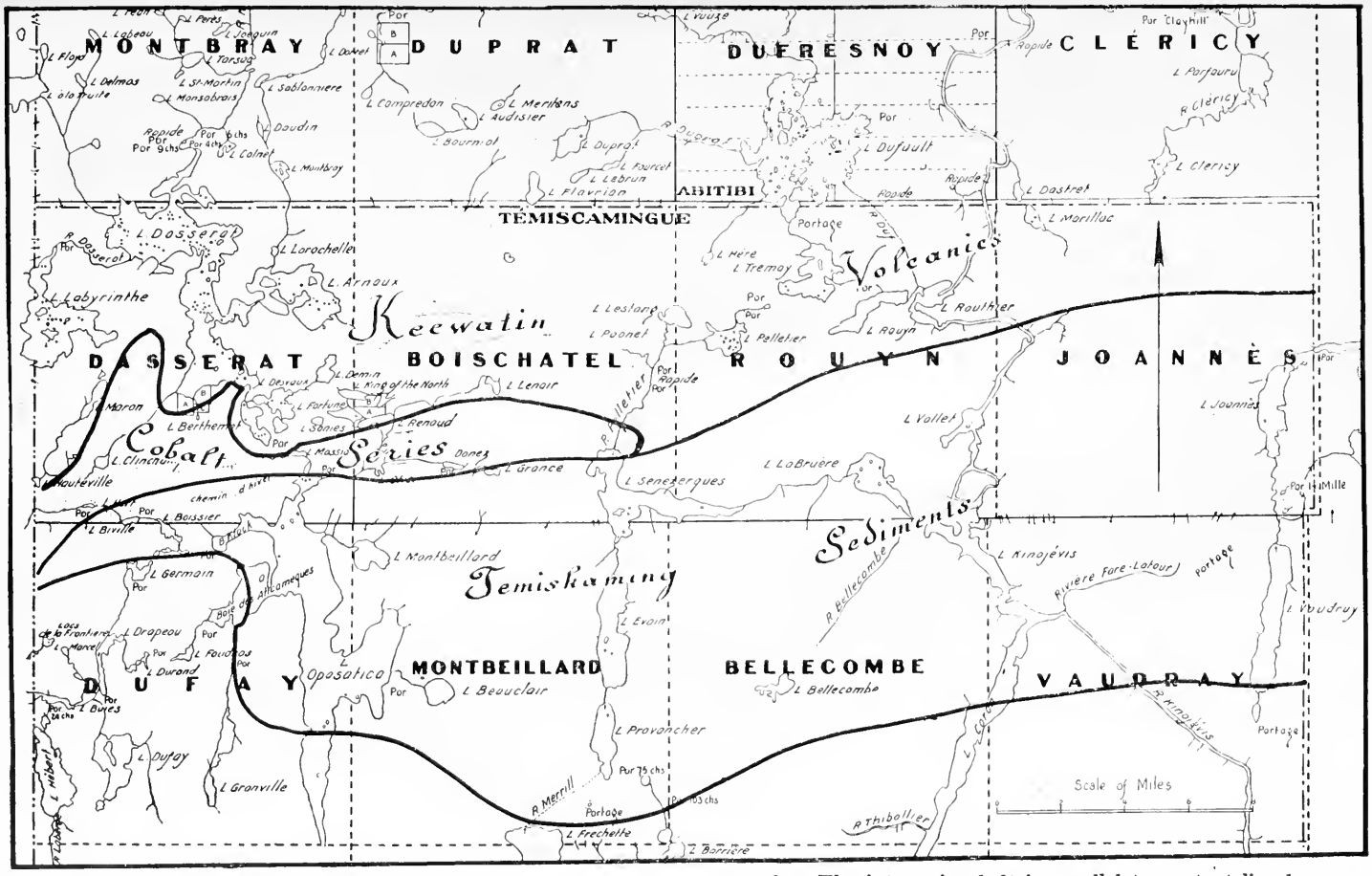
In a preliminary report issued in October 1922, by the Ontario Bureau of Mines, it is pointed out that in northeastern Ontario, an important gold bearing zone follows a belt of Temiscaming sedi-

ments, having an east and west trend, which was traced in Ontario for a distance of 60 miles. This mineralized belt contains the Matachewan deposits; the Kirkland Lake gold camp; and the Larder Lake deposits. It is in the extension into Quebec of this Matachewan-Kirkland-Larder gold belt that the prospecting rush is taking place. Before the winter snow covered the ground in the fall of 1922, some preliminary work had been done on several of the claims in Boischatel and Rouyn townships, and the results were sufficiently encouraging to induce the claim holders to bring into the district, over winter roads, diamond drills and light mining equipment to carry on prospecting and development throughout the winter.

The influx of prospectors into the region began in March 1922, and by the end of the summer 35,000 acres had been staked out in mining claims. The rush was continued all winter, but most of the staking from November to May has to be done on the snow, and the claim staking during that period is, to a great extent, a matter of haphazard, as regards the value of the ground for mining. By the middle of March of 1923, the records of the Quebec Bureau of Mines showed that, in round numbers, during the preceding twelve months, some of 640 claims, covering 86,000 acres had been staked and recorded, distributed as follows: Rouyn 340 claims covering 44,800 acres; Boischatel 120 claims, 18,000 acres; Joannès 60 claims, 8,000 acres; Dufresnoy 45 claims, 6,400 acres; Dasserat 35 claims, 4,400 acres; Dufay, Montbeillard, Bellecombe, together, 40 claims, 5,000 acres.

By the preliminary work that has been done, several considerable bodies of ore have been revealed. It is a remarkable fact that few assays have been blank. Contents of $7.00 to $15.00 a ton are numerous, and many grab samples have given high results.

Although the assays are not spectacular, they are notably consistent, and there are indications of the possibilities of large tonnages in several places. In Rouyn township a group of claims on Héré Lake have been optioned to a Toronto syndicate, organized by Mr. J. Hammil, and on one of these claims two diamond drills were at work in March 1923. Another group, organized by Messrs. Thomson and Chadbourne, of New York, under the name of "The Noranda Mines, Ltd.", controls several claims, among which the Powell and the Horne claims, two of the earliest staked. On the



Sketch map showing outlines of geological formations in new gold fields. The interesting belt is parallel to contact line between Temiscaming sediments and Keewatin Volcanics, from 1½ miles south of this line to 6 miles north of it.

Powell claim a small complete mining plant, to sink to a depth of 300 feet, was brought in over the snow roads and will be set up as soon as the snow is off the ground.

During the summer of 1922, two geological parties, sent in by the Department of Mines, under Mr. H. C. Cooke, made a study of the geology of an area of 900 square miles and his report and map are now in press and will soon be available to the public. By kind permission of the Director of the Geological Survey, extracts of Dr. Cooke's report are reproduced here under. As Dr. Cooke's complete report will show in detail, numerous large bodies of porphyries, as well as of syenite and granite intrusions, were noted; and taking into account the keynote of the advice of official geologists of the Ontario Bureau of Mines to the prospectors, which can be summed up in one sentence. "*For gold deposits look for feldspar porphyry and quartz porphyry intrusions in or near the great belts of Precambrian sediments, particularly the Temiscaming series*", this area in the Province of Quebec is most promising.

Attention is called to the fact that the belt of Temiscaming sediment, which is shown on the little sketch map (page 51) as covering parts of the townships of Dasserat, Dufay, Beischatel, Montbeillard, Rouyn, Bellecombe, Joannès, and Vaudray, extends to the east for a further distance of at least sixty miles, to beyond the Bell river, retaining a width of six to ten miles, and that the whole of this development is well worthy of intensive prospection.

EXTRACTS (1) *FROM REPORT ON OPASATICA MAP-AREA, NORTHERN QUEBEC*

(By Dr. H. C. Cooke)

Introduction

The study of the belt of gold-bearing rocks that extends from Matachewan district to Larder Lake district indicated that the Temiscaming series and, probably the gold-bearing porphyries, extended eastward into Quebec. Accordingly it was decided to commence, in 1922, detailed mapping in Quebec. Events have

(1) By permission of the Director of Geological Survey, Dept. of Mines, Ottawa.

more than justified the course, for in the latter part of the summer of that year promising gold discoveries were made within the area mapped.

General Character of the Area

Means of Access.—The map-area is easily accessible either from the south, west, or north. The route from the west is probably the easiest for the traveller with little baggage. From Dane station on the Temiscaming and Northern Ontario railway a stage makes daily trips eastward to Larder lake, a distance of 18 miles. Motor boats may be obtained to cross Larder lake, 8 miles, and from the east end of the lake there is a fairly good road 17 miles long, to the Lake Fortune mine. This road is reported to extend a further 14 miles to Rosebury lake, (Héré lake).

From the north there is a good canoe route, by which a trip may be made easily in two days from the National Transcontinental railway to Opasatica lake. Starting from La Sarre, a town of about a thousand inhabitants, the route follows La Sarre river some 8 miles to lake Abitibi, crosses the lake, and runs up the Abitibi river to Duparquet lake; then up Kanasuta river to Dasserat lake and Ogima lake (Berthemet lake), from which two short portages lead to Opasatica lake and the road to Dane. There are only seven portages on this route, all short except the one between Ogima (Berthemet) and Summit lakes, which is a trifle more than half a mile in length.

The southern route, although longer than the other is probably the easiest for a party bringing in a large quantity of supplies. From Liskeard or Haileybury, on the Temiscaming and Northern Ontario railway, one may travel by steamboat or motor car to North Temiscaming, at the head of lake Temiscaming, whence a fairly good road 28 miles long runs north to the foot of Opasatica lake. A loaded team can cover the distance easily in one day, and it is said that the Quebec Government intends to improve the road in the near future so as to make it easily passable for motor cars and trucks. From the foot of Opasatica lake to the head of the lake, 20 miles, recourse may be had to canoe or motor boat.

Another very good, but still longer, route to Osisko lake, (Tremoy lake), starts at Gillies Depot, on lac des Quinze, which

may be reached by motor truck from Ville-Marie in a couple of hours. The canoe route lies up the east arm of Quinze lake through lake Expanse, up the Ottawa and Kinojevis rivers, through Kinojovis lake to Routhier lake and Rouyn lake. From Rouyn lake there is a portage three-quarters of a mile long to Osisko lake (Tremoy lake). The route is about 75 miles in length but has the advantage of being an all water route except for the one portage mentioned.

General Geology

Opasatica map area is similar in a general way to the remainder of the Temiscaming region, and particularly resembles the Larder lake area directly to the west. Nearly all the rock types found in the Larder area (1) occur in Opasatica area.

The primary subdivision of the rocks, based on their age relations, is a dual one. The younger group is represented in Opasatica district only by the rather flat-lying sediments of the Cobalt series. These rocks are separated from the underlying older division by a great unconformity, which represents an enormous interval of time during which these older rocks were being gradually worn away and carried by streams to the sea. It has been estimated that the thickness of rock removed during this long period of erosion was at least 14,000 feet, and may have reached a maximum of over 30,000 feet. (2)

The older group of rocks is a complex whose component parts are becoming every year better known. It includes two great series of surficial rocks (3), which are everywhere intruded by a variety of igneous rocks. The younger of the two series is known as the Temiscaming series, and consists predominantly of sediments, but may contain locally large volumes of lavas. It rests with pronounced unconformity on the older series, the Keewatin, which is composed largely of lavas with minor amounts of sedimentary material. The igneous rocks intruding the surficial formations are of great variety, and will be dealt with fully in the detailed section of this report.

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(1) Larder Lake district, Ont., Geol. Surv., Can, Mem. 131 pt. 2, 1922.
(2) The Larder lake district Ont., Geo., Surv. Can., Mem. 131, p. 38, 1922.
(3) i. e. rocks laid down on the earth's surface.

The rocks and their age relations may be summarily presented in the following:

TABLE OF FORMATIONS

Quaternary	Post-glacial	Clays, silts, sands.
	Glacial	Boulder clay, stony and gravelly morainic deposits.
Huronian	Cobalt series	Conglomerate, greywacke, arkose, argillite.
	Great Unconformity	
	Pre-Huronian intrusives	Basaltic diabase Later gabbro Syenite Hornblende-mica lamprophyre Syenite porphyry Granite Older gabbro.
		Folding
		Diorite porphyry Amphibolite Hornblende lamprophyre.
	Temiscaming series	Conglomerates, greywackes and basalts.
	Unconformity	
	Keewatin	Basalts, andesites, dacites, rhyolites and tuffs.

Keewatin Basalts.—Basalts form the bulk of the Keewatin rocks, as in most areas. They are mostly dark, olive-green rocks, to which the name greenstone has been fittingly applied. When fresh they consist of labradorite and pyroxene, but commonly they are so badly altered that only traces of the original minerals are visible, in a mixture of chlorite, kaolin, epidote, and other secondary products. They are mostly massive, except where sheared along fault planes or at the contacts of two flows where movement during folding has been concentrated. Consequently, in spite of the alteration they have undergone they retain their original structures and textures and exhibit them remarkably well in clean weathered surfaces.

The basalts are mainly rather fine-grained, equigranular (1) rocks with a grain rarely greater than 1mm. in the coarser parts of the flows, and decreasing to exceedingly fine grained, almost glassy, in the upper parts of the flows. They frequently possess pillow structures, more rarely flow and amygdaloidal textures.

It is interesting to observe that in Opasatica area, as also for at least 60 miles to the west of the Ontario boundary, basalts form the bulk of the Keewatin rocks, with minor amounts of dacites and rhyolites and very little andesite. This is sharply in contrast with the Keewatin in north-central Quebec, west and southwest of lake Chibougamau, where the amount of andesite is perhaps 35 per cent or more of the total bulk, and the amount of acid types is small very.

Dacite, Trachyte, Rhyolite.—Acid lavas are found in many places throughout Opasatica area. Quite a thick body of them occurs on Mishikwish lake (Arnoux lake). They were observed in several places on Dasserat lake, on Washusk (Desvaux) and Uwass (Demin) lakes, at the east end of Pelletier lake, near Osisko lake (Tremoy lake), and in a number of other localities.

These rocks are very well described by the term "grey lavas" that has been recently applied to them by the geologists of the Ontario Department of Mines. They are cream-white to grey white rocks, invariably fine grained though often finely porphyritic, and usually, though not always, altered to rather soft kaolinic

(1) Equigranular—meaning that all the mineral grains composing a specimen of rock are approximately equal to one another in size. The average size of the mineral grain is termed the "grain" of the rock.

aggregates. Amygdaloidal textures are very common, the amygdules being usually filled with quartz. Good pillow structures occur in many places in the dacites and trachytes.

Tuffs.—Coarse volcanic breccias made up of angular fragments of lava, without bedding, occur here and there throughout Opasatica area, interbedded with the volcanic flows. Of greater interest are the fine-grained bedded tuffs found in the eastern part of the area. They form a band about 4 miles in length in the map-area, with a maximum width of half a mile, to the south of Pelletier lake lying between the Keewatin lavas and the Timiscaming conglomerate. At the west end the band wedges out, at the east end it continues on unbroken into territory not yet mapped.

They are black or greyish black, rather soft rocks, for the most part very fine-grained, and thinly and uniformly bedded. The beds vary from one-eighth inch to 4 or 5 inches in thickness, and the individual beds may be traced across outcrops several hundred feet in length. Evidently therefore they were laid down in bodies of quiet water.

The tuffs lie stratigraphically above the main body of lavas to the north, and are interbedded with small basalt flows; and there is no evidence of unconformity between them and the basalts, but every indication, on the contrary, that they were laid down directly on the uneroded surface of the flows. It cannot be doubted, therefore, that there was no extensive interval of time between the deposition of the basalts and that of the tuffs, and, consequently, that the tuffs are a true member of the Keewatin series.

Around Pelletier lake and southward to the boundary of the Timiscaming series, a distance of at least 2 1-4 miles, the Keewatin lavas and tuffs are tilted into vertical attitudes and all face toward the south; that is, the present south side of each individual bed or flow is the side originally uppermost at the time of its formation. This area, therefore, forms part of the south limb of an anticline or the north limb of a syncline. The strike is nearly due east and west near the Timiscaming contact on the south, and, farther north, gradually swings south of east.

In the neighbourhood of Dasserat lake a larger number of observations on structure were obtained. At the north end of the lake, and for at least 5 miles south, past the mouth of the inlet to Mishikwish lake (Arnoux lake), the flows all have an approximately

east west strike, and their upper sides face toward the south. The angle of dip varies from about 60 degrees south at the north end of the lake, to vertical near the mouth of the inlet to Mishikwish lake (Arnoux lake); while still farther to the south, at the east end of Uwass lake (Demin lake), the strata are overturned and dip 70 degrees north.

All the structural determinations made on Washusk (Desvaux), Ogima (Berthemet), and the south end of Dasserat lake show the lava flows with approximately east-west strikes, but with the upper sides of the flows facing northward. These flows, therefore, form the south limb of the syncline of which the flows described in the last paragraph form the north limb. The axis of this syncline must pass somewhere between the north end of Uwass lake (Demin lake) and the north end of Washusk lake (Desvaux lake), and across Dasserat lake somewhere between the south shore of Renault bay and a point about a mile to the north.

There are, according to the foregoing, two great synclines in the Opasatica area, one around Dasserat lake, with its axis running somewhat south of east, and one around Pelletier lake. The position of the axis of the latter has not been directly determined, but it must lie at least 3 miles south of the lake, and must strike in a general east and west direction. The measured width of one limb of the Dasserat fold is over 5 miles, so that it must be approximately 10 miles north or south from one synclinal axis to the next.

Now, if the axis of the Dasserat syncline be projected eastward along the strike, it passes close to the probable position of the Pelletier syncline. It is therefore highly probable that the two axes coincide, and that one great fold passes across the whole area. If this be true, the flows around and south of Pelletier lake correspond in stratigraphic position to those around the northern part of Dasserat lake; that is, they all form part of the north limb of one syncline.

Timiskaming Series

Distribution.—The Temiskaming series forms a belt 10 or 12 miles wide to the south of the Keewatin. The two are in direct contact in Rouyn township and the adjacent part of Boischatel township, but throughout Dasserat and the greater part of Boischatel township the contact is covered by a tongue of the overlying

Cobalt series. In the western and middle parts of Dufay township the width of the Timiskaming is reduced to a mile and a half by the intrusion of the granite batholith.

Lithological Character.—The Timiskaming series of Opasatica area consists of a very thick conglomerate member next the Keewatin, overlain by sandy greywackes. Interbedded with the greywackes on Opasatica lake area some basic lavas, which are now badly altered, but must originally have been of about the composition of basalts. The whole series has been so strongly compressed during the folding movements as to be largely converted into schists.

Folding.—The great body of Timiskaming sediments in Opasatica area has the general structure of a synclinorium, or great syncline, made up of several subordinate anticlines and synclines. The south side of the synclinorium is not visible, as it has largely been destroyed by the intrusion of great batholiths of granite; but inclusions of the Timiskaming rocks in the granite, some of them miles in length, show that the sediments once formed a belt more than 25 miles in width from north to south.

Correlation.—The conglomerates and greywackes here termed Timiskaming series were termed the Pontiac series by M. E. Wilson, who considered, on various grounds, that the sediments underlie or are interbedded with the lavas of the Keewatin (1). In a recent paper (2) the writer showed that the Pontiac series is probably to be correlated with the Timiskaming series of Kirkland Lake and Larder Lake districts, and the work of the past summer has strengthened greatly the conclusions previously reached. The name Timiskaming series is therefore used throughout this report, instead of Pontiac series.

The Timiskaming of Ontario and the Pontiac of Quebec are alike in composition and succession of formations. They were laid down under identically similar conditions, on a floor of Keewatin rocks that was folded and eroded to about the same extent in both districts, and they were later folded so that the strike of the axes of folding and even the plunge of those axes are similar in the two districts. Also the areal relations render it improbable that the two series are other than really separated parts of a single series.

(1) Wilson, M. E., Geo. I. Surv., Can., Mem. 39 and 103.
(2) Journal of Geology, 28, p. 304, 1920.

These facts appear to justify correlation of the Timiskaming and the Pontiac; and accordingly the name Timiskaming, as the earlier of the two names, has been applied to the series in Opasatica area.

Comparison with the Timiskaming of Ontario.—While discussing the general relations the Timiscaming series in Quebec to that in Ontario, attention may be drawn to one or two interesting comparisons. The thickness of the series in Quebec has been estimated roughly as about 7,000 feet (plus or minus 1,000 feet). The thickness in the western end on the Larder Lake area was determined to be about 3,600 feet (1), that in Teck township about the same (2). It may be that this difference of thickness is due to original difference in deposition; that is to say, that the Temiskaming was originally laid down thicker in Quebec than in Ontario. More probably the difference is to be explained by the eastward plunge of the folds, which has carried the bottoms of the synclines to a greater depth in Quebec than in Ontario. The series thus had probably much the same original thickness in Ontario as in Quebec, but greater thicknesses have been removed in Ontario by erosion. Thus the figure 7,000 (plus or minus 1,000) feet is probably a closer approximation to the original true thickness of the series than is the figure obtained in Ontario. Since the folds still plunge to the east at the eastern side of Opasatica area, it should be possible to obtain in that direction a still closer determination of the original thickness.

Again, in Teck township a great part of the total thickness of 3,600 feet consists of conglomerate; in fact, almost the whole of the series is interbedded conglomerate and greywackes, corresponding to what in other places the writer has termed the conglomerate member of the series. In Rouyn township, Quebec, the conglomerate member, consisting mostly of conglomerate with some interbedded greywackes, is 4,500 feet thick, or more in one place. In Larder Lake area the thickness of the conglomerate member varies from zero to 600 feet.

Post Timiskaming Intrusives

The post-Timiskaming intrusives of Opasatica area include almost all these found in Larder area, together with some not ob-

(1) Geol. Surv. Can., Mem. 131, p. 30.
(2) Jour. of Geol. 28, p. 321.

served there. Like the Larder Lake intrusives they may be subdivided into two main groups, the earlier group including those intruded before the Timiscaming series was folded, the later group, those intruded after folding had occurred. All of them are older than the Cobalt series.

The earlier group includes, beginning with the eldest: hornblende lamprophyre, amphibolite, and diorite porphyry. In the later group fall the older gabbro, granite, syenite porphyry, hornblende-mica lamprophyre, syenite, later gabbro and basaltic diabase.

Comparison of Porphyries in Opasatica, Larder, and Teek Areas.

It is of special interest to note that in Opasatica area no bodies of the syenite porphyry have been found cutting the greywackes of the Timiskaming series, nor has Wilson noted the existence of any such in the greywackes, between Opasatica area and Kiekkiek lake 22 miles to the east, although in that distance there are two or three water routes across the greywacke areas which afford good sections. The two porphyry masses that intrude the Timiskaming of Opasatica area are both low down in the section. One, between Olier and Renaud lakes, is in the conglomerate close to the Keewatin contact; the other, at the north end of Kekeko lake, is in the conglomerate about 4,500 feet stratigraphically above the contact. Numerous dykes of porphyry cut also the Keewatin to the north of the Timiskaming.

The association indicates what has been observed elsewhere, that the porphyry tends to form dykes in the Keewatin, and sills where it intrudes the bedded rocks of the Timiskaming series. *It also strongly suggests that the intruding porphyries found it difficult to break through the bedded Timiskaming rocks, and hence have tended to spread out into sills along some bedding plane at or near the base of the series.* On account of the far greater thinness of the series in Ontario, this possibility has not hitherto been noticed, but an examination of the geological maps of Larder and Teek areas seems to confirm it. In Larder area the largest mass of porphyry lies just below the Timiskaming series, in the anticline between Beaver lake and Malone lake; and all other masses of porphyry intruding the Timiskaming lie comparatively near the base of the series. In the Teek area the series is only 3,500 feet thick, and one might therefore reasonably expect to find porphyry almost anywhere.

This seems to be the case although even here there is a suggestion of some slight concentration of the porphyry masses toward the Keewatin contacts.

The above conception must be tested by further field work east of Opasatica area before it can be considered as confirmed; but there seem to be enough facts to justify a prophecy that very few sills of porphyry will be found cutting the Timiskaming greywackes, but that, on the contrary, most of the porphyry masses cutting the Timiskaming series will be found at, or slightly south of, the Keewatin contact: *and therefore since the porphyries are generally admitted to be the source of the gold ores the most favourable area for prospecting in the Timiskaming series is the band about a mile wide on the south side of the contact.*

Historical Summary

A brief historical summary of events up to this point may help to create a clear picture in the mind of the reader. The period described commences with the outpouring of the great floods of lava and their accompanying beds of tuff that now form the Keewatin. How long this period may have been, there is no means of knowing. The great thicknesses of lava, over 4 miles on Dasserat lake, with neither bottom nor top exposed, undoubtedly required a great length of time to accumulate, but flow must have followed flow with considerable rapidity, geologically speaking, for weathered material is rarely found between flows, or old soil, such as would be rapidly formed had the lavas been poured out on land and left uncovered for any length of time; or any normal bedded sediments such as might be expected had the flows been poured out beneath the sea and not been covered with more lava within a few years. The Keewatin may be confidently assumed, therefore, to have been a period of almost constant extrusion, in this area at least, with an average of at least one great flow per century. The presence of beautifully bedded tuffs at the top of the series, in Rouyn township, the occasional occurrence of thinly bedded cherts between flows, and the almost universal occurrence of pillow structures in the lavas all point to the conclusion that the extrusions were submarine, at any rate in Quebec and adjacent parts of Ontario (1), so that the area was covered by the sea or by some other large body of water.

(1) There is evidence that extrusion was not submarine in the vicinity of Lake Huron. W. H. Collins, personal communication.

After the period of extrusion ended, the lavas were raised above sea-level by mountain-building movements and gently folded. Apparently a range of mountains, probably rather low, was formed to the north of the present Timiskaming area. Almost certainly some batholiths of granite must have been intruded into the lavas at the time of the folding, because a few pebbles of coarse granite are found in the overlying Timiskaming conglomerate.

As soon as uplift brought the rocks above sea-level, they began to be worn away by rain, running water, and the other agencies of erosion. Erosion was undoubtedly rapid not only because of the rugged nature of the country, but also because of the lack of vegetation in that early time. The mat of roots that now covers the earth's surface wherever climatic conditions permit, and which effectively prevents running water from carrying away any large proportion of soil, was then entirely absent; and consequently every rain storm must have swept great quantities of mud, sand, and gravel into the streams, to be carried to the sea. The land at that time must have been a scene of unimaginable desolation; black lava everywhere, carved no doubt by the weather into cliffs, spires, and an infinite variety of weird shapes; with the gloomy tints of basalts relieved here and there, it is true, by the lighter colours of rhyolite or dacite, but without a trace of the soft green of vegetation; with the surface everywhere piled high with blocks, boulders, and masses of rock, from between which almost every particle of soil had been swept by running water. From the mountains rushed torrential streams, black with lava mud and rolling quantities of gravel and boulders along their beds to the plains below.

Such were the conditions that prevailed after the uplift of the Keewatin lavas, when the deposition of the Timiskaming series commenced. The great conglomerates at the base of the series appear to have been huge flat, fan-shaped deposits, laid down at the foot of the mountains at the mouths of outrushing streams. When the streams passed from the steep slopes of the mountains to the flat slopes of the plains, their velocity was checked, and consequently they had to drop a great part of the load they carried—naturally, the coarsest material. Their bed thus filled up, the streams were forced to break out, first in one place, then another, depositing wherever they went, till long and broad lenses of gravel of great thickness were formed.

The next event is more obscure. Perhaps great lakes were formed in some way. Perhaps the deposition of the great weights of gravel caused the land to sink locally below the sea-level. In one way or other the area where the gravels were laid down became covered with a rather shallow body of water, in which deposition took place, not of gravel, but of sands. As thousands of feet of sand were deposited the second hypothesis is probably the correct one, and sinking of the sea bottom kept pace, approximately, with deposition. Had the areas been lakes, they would have been filled up quickly. Here and there an occasional volcano smoked, contributing the lavas that now form local members of the Timiskaming series.

Then began the series of earth movements that uplifted the newly-formed Timiskaming series and folded them. They began with the intrusion, in small quantities, of igneous rocks, hornblende, lamprophyre, amphibolite, and diorite porphyry. These tended to form sill-like masses, rather than dykes, in the still flat-bedded sediments. Then came tremendous horizontal thrusts, so violent and long-continued that the Timiscaming strata and the underlying lavas were turned on edge, and even overturned in places. The earth movements then gradually died away with the intrusion of various igneous rocks, gabbros of several types, granite, syenite porphyry and syenite, and the hornblende-mica lamprophyres. Most of these were small, relatively speaking, except the intrusion of the granite, which was vast and widespread. It welled up slowly in enormous masses which ate their way forward by breaking off masses of the overlying rock, that sank in the liquid granite, or were dissolved by it. The thickness of rock thus stoped away by the granite are to be measured in miles, rather than in any lesser unit. In the southern part of Opasatica are, not only the 7,000 feet or more of Timiskaming series have been thus eaten away, but also all of the immense underlying thicknesses of lavas, together with all of the unknown floor on which the lavas were laid down.

The folding movements, more intense and widespread than anything in later geologic history, must have converted northern Canada into a mountain area, comparable in elevation to the highest ranges in the world to-day. Consequently a very long period of time next elapsed, during which no permanent body of sediments could be formed in the area, while erosion gradually wore

down the mountains and reduced the whole region to sea-level or near it. In this period, the writer has calculated, between 14,000 and 30,000 feet of rock were removed from the area by erosion. (1) Where this vast amount of material was deposited is not yet known. Finally, northern Ontario and Quebec were reduced to a plain-like surface, near to sea-level, somewhat like the present surface in detail, though probably flatter. On that surface outcropped not only the former Keewatin rocks and the remnants of the Timiskaming synclines, but also granites and other intrusives, whose original sedimentary cover had been entirely removed when the mountains were worn down. On this surface the deposition of the Cobalt series began.

Cobalt Series

The Cobalt series in this area has been fully described by Wilson (2) and the work of last summer adds only a little to the information he has given. The series in Opasatica area consists wholly of the lower beds, grouped by Collins (3), under the name Gowganda formation. It includes large quantities of conglomerate, interbedded with greywackes and impure quartzites, together with some fine-grained, blackish greywacke or argilite. The thickness of the series here, between 500 and 1,000 feet, represents only a fraction of the original thickness, for the greater part has been removed by erosion.

Quaternary

Quaternary deposits cover a large proportion of Opasatica area. They include, mainly, glacial drift and post-Glacial lake deposits.

The glacial drift is found in varying quantity everywhere throughout the area, underlying the post-glacial lake deposits, and projecting up through them in ridges and knobs. Most of the drift consists of sand, gravel and boulders although boulder clay

(1) Geol. Surv. Can., Mem., 131, pp. 37-40.
(2) Geol., Surv., Can., Mem. 39, pp. 83-98.
(3) Geol., Surv., Can., Mem. 95, p. 63.

is to be found here and there. In places terminal moraines of the continental ice-sheet occur, characterized by the usual knob-and-kettle type of topography. A heavy terminal moraine forms a rather pronounced ridge across the portage between Summit and Ogima (Berthemet) lakes, damming the old stream channel so as to form those lakes; it runs then northeast along the north side of McDonald Lake, passing between Uwass (Demin) and King-of-the-North lakes. Large morainic hills are found also around Kilburn lake, and in various other parts of the area. A larger esker, or deposit formed by a glacial stream, occurs on the west side of lake Evain.

Post-glacial lake deposits cover, however, by far the larger part of the area. There are the sediments that were laid down in the bed of large shallow lakes formed during the retreat of the last ice sheet. Such lakes were formed whenever the ice sheet, in its northward retreat, retired over a divide; so that the waters from the melting ice were ponded between the divide on the one side and the edge of the ice sheet on the other.

Into the lakes poured streams of water from the melting ice sheet, loaded with the fine rock powder formed by the grinding of the ice sheet against the underlying rock. The sediments settled in the quiet waters of the lake, and formed characteristic deposits of thin-bedded clays and silts, with more or less sand near the original shores.

Economic Geology

The elements of principal economic interest in Opasatica area is gold. Gold was discovered in the summer of 1906 by Messrs. Ollier and Renault in the large shear zone between Renaud and Fortune lakes. Their discoveries attracted a number of other prospectors to the locality, who carried on work in adjacent territory without finding anything of value. Meanwhile, in 1907, the original discovery was taken over by the Pontiac and Abitibi Mining Company. The latter company proceeded vigorously with development work, built and equipped a mill, assay office, engine house, saw-mill, and camp buildings. They sank to the north and south. The commencement of the war put an end to the work, and the company afterwards went into liquidation. The property was taken over in great part by the present holder, the Lake For-

tune Mining Company, that has carried on a small amount of work during the past summer, getting the property cleared of second growth, the shaft pumped out, and the various workings sampled.

A small amount of desultory prospecting had been going on in the district up to the beginning of the war, stimulated by the original discovery at Fortune lake, and by later discoveries to the east. Nothing of economic value was discovered, however, and in 1914 prospecting practically ceased altogether for several years, except for the effort of Renault, the original discoverer of the Lake Fortune property, who for some years has been prospecting three claims on the south side of Renault bay, and Dasserat lake, and some claims on the south side of Mishikwish lake (Arnoux lake).

Some three years ago, it is said, a hunter by the name of Horne happened upon a large deposit of sulphides near the northwest corner of Osisko lake (Tremoy lake) Rouyn township, surface samples of which gave high values in gold. He apparently did not publish the news of his find, but continued to prospect it and the surrounding district quietly until the spring of 1922, when a mining engineer came in to sample the property. The assays reported were so high that the attention of prospectors was turned to the area. Interest was still further excited by another reported discovery on Pelletier lake, in the spring of 1922, by Messrs. Wright and Billings, who, it is said, showed rich specimens of free gold alleged to have been found at that place. During the summer of 1922 there was a continuous thin trickle of prospectors into the area, rapidly swelling to a flood with the announcement of the Powell discovery, at the end of September, on the southeast side of Rosebury lake (Héré lake). Although it was then too late to accomplish any real prospecting, the country has been staked solidly for some miles on every side of the latest discovery.

The geological examination of the district has shown the northern part, at least, to be a most promising field for prospecting. Dykes of syenite porphyry, which is now commonly considered to be the source of the gold, are numerous in the Keewatin area, particularly throughout the area between Renaud and Osisko (Tremoy) lakes, and, as already described, there are also two intrusive, probably sill-like masses in the lower horizons of the Timiskaming series. It is interesting to note that all the gold discoveries are confined to the same general area.

There are also many dykes of the fine-grained, reddish syenite in the area above-mentioned, and, as already pointed out, this rock is found in many places to be impregnated with pyrite, and to carry values in gold up to $2 or $3 a ton. It is possible that places may be found, in which values are sufficient to render the rock an ore. In any case, the presence of such values in the rock itself suggests strongly that the syenite is also a source of gold, and that deposits of value may be found in the vicinity of the dykes.

The principal difficulty encountered in the district by prospectors is the heavy mantle of post-glacial clay, which covers the larger part of the area and confines prospecting to the few small areas where outcrops project.

As the writer stated in an article published some years ago (1) there seems to be reason to expect similar geological conditions to prevail, not only in Opasatica area, but also to the east as far as the Timiskaming belt extends, that is, nearly to Bell river. The geological work of the past summer, and the discoveries of gold, confirm this prediction as to Opasatica area, and further suggest that the most favourable prospecting ground, of this belt, is to be found in the Timiskaming series, probably within a mile and a half of the northern contact; and in the band of Keewatin lavas and tuffs 4 or 5 miles wide along the north side of the contact.

Lake Fortune Mining Company

The claims of the Lake Fortune Mining Company are on the south shore of Fortune lake and the north shore of Renaud lake. This property was the first discovery of importance in the region and its history has been briefly outlined. The principal workings and the buildings lie in the small area between Fortune and Renaud lakes. The rocks are Keewatin basalts, cut by two dykes of syenite porphyry, highly irregular in shape and very variable in width. The larger dyke has an average width of 12 to 15 feet, but widens in one place to more than 100 feet; the smaller is about 15 feet wide at its largest exposure, but narrows down to a stringer less than 1 foot wide. The ore deposit lies in a strongly sheared zone, presumably formed by faulting, that strikes a slightly north of east (astronomic) and has been traced from the middle of the

(1) Journal of Geology, 28, page 314, 1920.

east side of McDonald lake (Sonies lake) as far as lake Fortune, where it passes beneath the lake. It averages 6 to 12 feet in width for the most part, except for a distance of some 5 or 6 chains at the eastern end, where the sheared belt is 200 to 300 feet wide Throughout the greater part of the observed length there is very little vein material in the sheared zone; between Renaud and Fortune lakes, however, it contains much quartz, carbonate, and sulphides. It is to be noted that the mineralization is near the dykes of syenite porphyry, an association that appears to argue a genetic connexion between the two. On the other hand, the larger of the two porphyry dykes is cut by the shear zone in one place, and altered to sericite schist; so that the period of vein formation must have been later than that of the dykes.

The principal vein materials are quartz, a carbonate (ankerite with more or less calcite), fuchsite, (a chromelithium mica), pyrite, chalcopyrite, tellurides and free gold. Robert Harvie, who examined the deposit in 1910 (1), succeeded in separating a small quantity of the telluride, and found by analysis that it contained about 25½ per cent gold and 42 per cent silver, corresponding approximately to the formula for petzite, $(Ag\ Au)_2\ Te$. Mr. V. Dolmage, however, examined a polished surface of the same ore under the reflecting microscope and determined that two tellurides are present, which appear to be petzite and sylvanite (Au Ag.) Te_2 The precise determination is difficult, however. These tellurides are dark grey to black, opaque minerals, occurring in very small grains, as far as observed. They are slightly softer than calcite.

The gold values in the veins, according to Harvie, are obtained from the tellurides and the free gold. He states that the pyrite and chalcopyrite in the veins, on being assayed, yielded very low values.

No reliable detailed information concerning the tenor of the veins was available at the time of the writer's visit, so that no further conclusions as to the nature of the ore bodies or the origin of the ores could be drawn.

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(1) Report on Mining Operations in the Province of Quebec during 1910, p. 83.

Powell Claim

On the southeast side of Rosebury lake (Héré lake), in the northwest corner of Rouyn township, a large vein was discovered by T. Powell, late in September, 1922. Although the lateness of the season made an intensive prospecting of the vein impossible, the work done on it before the close of the season indicates it to be very promising. Unfortunately, owing of the poor communications prevailing in the district, the writer did not learn of the discovery until after leaving the field, and was therefore unable to make a personal examination. The following description was obtained through the courtesy of Mr. J. H. C. Waite who examined the property late in the fall of 1922.

The vein is of moderate size, striking astronomically north 33 degrees west. It has been traced with a rather high degree of certainty for about 2,500 feet; then it passes at either end into drift-covered areas of some size. However, outcrops in the drift-covered areas, on the projected strike of the vein or near it, are cut by a vein of similar character, which are probably the continuation of the known vein. If this be the case, the vein has a length of at least three-quarters of a mile. The width varies between 6 inches and 15 feet, averaging about 5 feet, and the principal vein mineral is quartz. Trenching has been done mainly in places where the drift cover is light, so that the intervals between trenches vary from 100 feet to 600 feet. It is evident that an examination of such preliminary character can yield no adequate conception of the tenor of the ore bodies, but the results obtained are sufficiently encouraging to warrant a thorough examination of the property, and prospecting of the vicinity. They indicate that the bulk of the vein material carried values averaging between $5 and $6 a ton, while there also appear to be here and there richer ore shoots, in which values rise to perhaps double the above figure.

Horne Claim

The Horne claim lies near the northwest corner of Osisko Lake (Tremoy lake), on the south side of a small creek entering the lake from the west. The rock is an acid rhyolite breccia, cut by dykes of coarse, badly altered gabbro, presumably the older gabbro. There are also some masses of a fine-grained basaltic rock so drift

covered that their nature and relations could not be determined; they are presumably dykes of the fine-grained basaltic diabase, the latest intrusive in the region.

The spaces between the rhyolite fragments in the breccia are filled with sulphides, and the rhyolite fragments themselves are more or less impregnated with and replaced by the sulphides. In some of the central parts of the deposit replacement has been complete, and the rock is converted into a solid mass of sulphides; while over a zone about 40 feet from east to west it was estimated that sulphides form about one-third of the bulk of the rock. The sulphides are pyrite and chalcopyrite, the pyrite predominating. Little quartz is present.

The strike of the bedding here is in doubt, as no good contact between flows were observed. One observation only was made, of very doubtful value. It appeared to be a contact between glassy lava against the rhyolite breccia, and the strike of the contact is almost due north. The observation is doubtful, because it could not be determined, on account of the drift covering, whether the supposed glassy lava is really a true flow or a dyke. If a flow, it is to be noted that the strike here is at right angles to the general regional strike; a condition that can be due only to local drag folding. This coupled with the highly fractured character of the rhyolite, suggests that the rhyolite flow may have been fractured by sharp drag folding, thus affording a good channel for the solutions carrying the sulphides. A similar type of occurrence is found in the great copper deposits of the Britannia mine B. C.; in which the important deposits are found only where the quartz porphyry band in which they lie has been bent sharply by later folding (1).

The deposit thus appears to strike about north and south, and has a width in one place of about 40 feet. Owing to the large amount of sulphides present, the surface is badly weathered, and is covered with a gossan of iron oxides a few inches to a few feet in thickness. The concentration of gold in the surface zone by weathering gave very high values to the samples first taken, and caused the discoverers to believe that the deposit was phenomenally rich. Unfortunately later sampling did not confirm this, but indicates that the tenor of the fresh sulphide ore is rather low, averaging perhaps $2 to $3 per ton. Higher values were obtained in

(1) Schofield, S. J., Personal communication.

one or two places, however, indicating that the deposit should be carefully prospected for rich ore shoots that migth convert it into a workable deposit.

Wright-Billings Claims

Claims were staked by Messrs. Wright and Billings on the south side of Pelletier lake, and also on some of the islands near the east side of the lake, in the spring of 1922. Their vein consists of massive bluish quartz, about 2 feet wide where it is exposed on the south shore of the lake. Mr. Billings states, however, that it widens to the west, and that their work in the later part of the summer exposed a width of some 15 feet. The quartz is cut by later veins of quartz and carbonate, one which also contains beautifully formed crystals of specular hematite up to half an inch in length. The vein material form a large lens in a shear zone of unknown length. The shear sone, formed presumably by faulting, strikes about 10 degrees north of east, and passes along the south shore of the west arm of Pelletier lake, and appears on two or three of the islands near the east side. Mr. Billings states that they traced it for about 5 miles east, and about 2 miles west, of Pelletier lake, and that it maintained its size and strike as far as they followed it. The average width is 5 to 10 feet. Over the greater part of its length it contains very little vein material; Robert Gamble stated, however, that he obtained some free gold by crushing and panning the schist on one of the islands near the east side of Pelletier lake. The quartz vein in the shear zone is said to contain gold values as high as $10 per ton, but it has not yet been systematically sampled.

It is interesting to note that a line drawn between the west end of the Pelletier lake shear zone and the east end of the Lake Fortune shear zone is very closely parallel to the general strike of each, about north 81 degrees east. It seems possible that the two are parts of a single long shear zone.

Other Claims

A number of claims have been described by Wilson (1), and as almost no development has taken place on them since his visit,

(1) M. E. Wilson.

the descriptions will not be repeated here. The recent staking in the area has been done almost entirely since the writer's examination was made, and consequently, no description can be given.

Generalized Statement

The preceding descriptions render it evident that the conditions accompanying gold deposition are the same in Opasatica district as in Kirkland Lake district. It has been proved that the folded sedimentary rocks of Kirkland lake, the Timiskaming series, are identical with the similar series in Quebec, formerly called the Pontiac series; so that in both districts the older lavas of the Keewatin are overlain by the Timiskaming sedimentary series, and both series are intruded by igneous rocks, among which is the gold-bearing syenite porphyry. In both districts the syenite porphyry forms dykes in the Keewatin lavas, and sill-like bodies in the Timiskaming sediments. In Matachewan district the porphyry has been definitely proved to be the source of the gold ores, and at Kirkland lake the proximity of porphyry bodies to the ore deposits renders it probable that the porphyry is again the source of the ore. In Opasatica district porphyry bodies have been found close to several of the ore deposits; and although the ore bodies are not yet developed sufficiently to yield definite proof of their genetic relation to the porphyry, the constant association of the two renders it probable that such a relation exists. Again, Burrows and Hopkins have called attention to the occurrence of the ore deposits at Kirkland lake in belts or zones, along which the rock has been fractured and rendered schistose by faulting. The individual descriptions above given show that the deposits found in Quebec also lie in similar zones of shattering or shear.

It is thus evident that the search for new ore bodies will be best carried on by looking first for belts of schists or shattered rock, secondly, for masses of porphyry. Belts of schists should be carefully followed up, and if they can be found to pass close to or into bodies of porphyry, such a place should be carefully prospected, as it is particularly favourable for the occurrence of ore. It might be added that the most favourable type of schist band is one that has an average width of 6 to 30 feet or thereabouts. Smaller bands are apt to be discontinous and hard to trace, and even if ore

were found in them it would have to be very rich to pay for working; as for the large schist bands sometimes found, 100 to 400 feet in width, these seem to have afforded too large a channel for any ore-bearing solutions that may have passed through them, so that even where deposition took place too great a volume of rock is mixed with the vein materials, and values are consequently low.

Summary

The work of the past summer in Opasatica area, Quebec, has yielded the following results:

1. The structure of the Keewatin lavas has been determined in two places, with interesting results.

2. The sediments of the area, formerly termed the Pontiac series, are definitely proved to overlie the Keewatin with both structural and erosional unconformity, so that their northward dip is due to overturned folding. Their relations to the Keewatin and to the younger intrusives, and their structures, are identical in every way with those of the Timiskaming series of Larder Lake area; they are therefore correlated with the Timiskaming series, and that name is applied to them throughout this report.

3. The thickness of the Timiskaming series in Opasatica area is calculated to be 7,000 (plus or minus 1,000) feet. The structure is that of a synclinorium of which all but the northern syncline and the next succeeding anticline has been destroyed by the intrusion of the granite batholith on the south. Inclusions and roof pendants of the Timiskaming series in the granite indicate that the belt of sediments was formerly more than 25 miles wide.

4. Almost all the intrusives found in Larder area are also found in Opasatica area, together with some that were not observed in the former area.

5. The examination of the Cobalt series in Opasatica area show that it was laid down, in one place at least, on a glaciated surface and in another place it presents characteristics that preclude any but a glacial origin. The striae on the underlying surface strike north 60 degrees east, and indications point to the existence of the ice centre to the southeast.

6. A study of the post-glacial lake beds indicates that there was two stages in the history of the post-glacial lake Ojibway.

During the first of these the lake extended, probably from lake Timiskaming, certainly from some point south of Opasatica map-area, northwards over the height of land for a long distance north of the National Transcontinental railway. The water-level then fell suddenly for 100 feet or more, draining the district north of the ridge of Cobalt series in Dasserat and Boischatel townships, while the area to the south of this ridge remained lake. The level of the latter lake appears to have fallen rather slowly to the present water-level, perhaps with a rather sudden drop in the last 15 or 20 feet.

7. There appears to be evidence in the topography of at least two periods of peneplanation with subsequent uplift. The first is tentatively correlated with the Cretaceous peneplain of the Appalachian region, or may represent the older Precambrian palaeoplain on which the Palaeozoic sediments were deposited, and removed by erosion after the Cretaceous uplift. The second is tentatively correlated with the Pliocene peneplain of the Appalachian region.

MICA

The shipments of mica in 1922 amounted to 890,547 lb., valued at $91,001. In value it is an increase of $48,779, or 115%, as compared with 1921, when the total value was only $42,222, the lowest figure reached since the Quebec Bureau of Mines began collecting mineral statistics, in 1898.

The mica market was somewhat better in 1922 than the previous year, but it was still far from satisfactory, the demand being very inactive.

It is not possible to compare the quantities year by year, as the mica is sold by the operators under various forms, rough culled, thumb-trimmed, thin-split and scrap mica, the values of which vary from $10 a ton for scrap mica, to $5 a pound for extra large thumb-trimmed mica sheets.

The 1922 production of mica can be roughly divided into the following proportion of grades:—thumb-trimmed 106,226 lb., valued at $32,534; thin-split mica 61,313 lb., valued at $50,956; Rough culled mica, 31,000 lb., $3,630; scrap mica making up the difference in weight and value, or 340 tons valued at $3,861.

The prices which ruled for thumb-trimmed mica during the year were as follows:—

1x1 in.....	$0 13 to $0 16 a lb	2x4 in.....	$0 60 to $0 85 a lb.
1x2 in.....	0 18 to 0 23 a lb	3x5 in.....	$1 25
1x3 in.....	0 25 to 0 35 a lb	4x6 in.....	1 55 to 2 50 a lb.
2x2 in.....	0 40 to 0 50 a lb.	5x8 in.....	$4 00
Extra large.	$5 00		

Reports were received from 55 operators, of whom 14 reported having shipped mica, 4 reported "prospecting only", and the balance, or 37, reported having remained idle all year.

MAGNESITE

The actual shipments of magnesite made in 1922 amounted to 2,853 tons, valued at $76,547. These shipments comprised dead-burned, calcined, and crude magnesite, which represented 5,645 tons of crude stone as extracted from the quarry.

Three operators reported shipments, viz: the International Magnesite Co., operating the Dobbie quarry, lot 13, range I, Harrington township; the North American Magnesite Producers, Ltd., lot 15, range IX, Grenville township; the Scottish-Canadian Magnesite Co., Ltd., lot 15, range XI, Grenville township.

In April 1922, an arrangement was entered into between the Scottish-Canadian Magnesite Co., and the North American Magnesite Producers, Ltd., whereby the latter did all the quarrying on their own property and the former did all the burning and sintering. The two properties are connected by a railway spur from the Scottish-Canadian narrow gauge railroad. The dead burned magnesite is shipped by this narrow gauge line, 13 miles to the C. P. R. station Magnesite.

There has been a gradual, but slow improvement in the magnesite market during the year. An entrance duty into the United States of $11.50 per ton was put in force in September 1922, and this has had a somewhat retarding effect on the demand.

In December 1922, the combined interests were taking steps to open a new quarry on lot 18, range XI, on the Shaw deposit, where there is magnesite rock of very good quality.

GRAPHITE

None of the graphite mines and mills were operated during the year 1922, the small shipments made, some 23½ tons, valued at $1,500, having been from stocks on hand from previous years operations.

The market has been very dull and prices low, but towards the end of the year, there was a slight improvement. The cause of the industry having remained at standstill in 1922 may best be exposed by quoting Professor B. L. Miller, on the graphite situation as follows: (1) "To so great an extent is graphite an international "commodity that it is impossible to resume active mining opera- "tions, until the supplies of all countries have been exhausted. "Ceylon, Madagascar, Japan, Austria, Bavaria, Czechoslovakia, "and the United States, are competing in the same market; and "most, if not all of them, are selling old stocks at far less than the "cost of war-time production, and even less than the present cost. "In March 1922, some 18,000 tons of unsold Madagascar graphite "remained on the island, and a large quantity in France. Stocks "in Ceylon are supposed to be extensive. Much unsold graphite "is in the hands of Alabama producers."

The *Standard Graphite Co. Ltd.*, with mine and mill at Guénette, on the Montreal-Mont Laurier line of the C. P. R. report that although thay have not produced, they have done construction work to a considerable extent, on mill and power plant, and they expect to be in a position to ship graphite early in 1923.

The *Laurentian Graphite, Ltd.*, with mines at St. Rémi d'Amherst, also report construction activity and mill alterations.

The *North American Graphite Company, Ltd.*, Buckingham, a new organization, has taken over the old North American mine, lot 28, range VI, Buckingham township, and expect to be in a position to operate and produce in 1923. This property, which was worked interminently from 1870 to 1912, has been idle for the last ten years; the predecessor to the present company was the Buckingham Graphite Company.

The new United States import tariff imposes the following duty on graphite. Amorphous graphite 10 per centum ad valorem;

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(1) B. L. Miller, Engineering and Mining Journal Press. January 20th, 1923. Page 104.

crystalline lump, chip or dust, 20 per centum ad valorem; crystalline flake, 1½ cents per pound.

MINERAL PAINTS

NATURAL IRON OXIDE

The shipments of natural iron oxide in 1922 amounted to 7,381 tons valued at $113,663, an increase of 25% in value over the preceding year.

The production of iron oxide comprises natural oxide, shipped raw after drying, used for purification of coal gas, and calcined ground oxide used in paint manufacture. The first sold for $3 a ton at shipping point, whereas the second sold at an average of $38.50 a ton.

The most important operator of iron oxide deposits is the *Canada Paint Company*, whose calcining plant and deposit of natural oxide are at Red Mill, east of Three Rivers. They operated to capacity all year, and in the fall they constructed another battery of reverbatory furnaces for calcining, which was started early in January 1923. More grinding machinery was set up, to both increase capacity and to grind finer, the trade specifications demanding increasingly finer mesh.

The Canada Paint also purchased new mining rights at Champlain, six miles east of Red Mill, to which a railway siding has been built, and these deposits are drawn upon for raw material which is treated at the Red Mill plant.

The iron oxide deposits at Little Romaine river, in Iberville township, have been acquired by a new organization, The *Paint River Oxide Co., Reg'd.*, who made a large sample shipment, by water, of raw oxide.

The *Montmorency Paint Products Co. Ltd.*, office 132, St. Peter Street, Quebec city, completed their calcining and grinding plant at Ste. Anne de Beaupré below Quebec city to work the deposit situated on the farm of Joseph Racine, and it was operated for about three months. The product is quite satisfactory and trial shipments were made. Owing to the state of the market, however, the plant was closed down towards the end of the year, awaiting an improvement in the market. The deposit was described in our last year's report.

The principal deposits of natural iron oxide of the Province of Quebec were described in our report for the year 1921.

Titanium White

In our last report, under the heading of Titaniferous Iron ore, we drew attention to the manufacture of titanium white, or titanium hydrate, as a white pigment, and the advantages it possesses over the white lead, and we mentioned the possibilities offered by our large deposits of titaniferous iron ores in this connection. The following extracts from a paper prepared for the Engineering Foundation, New York, will prove interesting:

"Some ten or twelve years ago, in the research department "of the Titanium Alloy Manufacturing Company, at Niagara Falls, "N. Y., the extreme opaquing or hiding power of the white pigment, "titanic oxide, when mixed with oil was noted. It was found, "however, that to manufacture titanic oxide to compete with other "opaque white pigments would be practically impossible. Further "research demonstrated that a composite pigment consisting of "only 25 per cent of titanic oxide thrown down on a base of pre-"cipitated barium sulphate, probably because of the wonderful "fineness of the particles and maximum distribution of the titanic "oxide, actually had approximately 80 per cent of the hiding power "of a pigment consisting of 100 per cent titanic oxide.

"This research, followed by careful tests to demonstrate the "availability of the composite titanium pigment, brought out the "fact that such a pigment had greater hiding power than any white "pigment known, was exceedingly inert to various vehicles (oils, "etc.), and other pigments, was non-poisonous, and had many "properties which made it unique among pigments. After several "years of research development, this pigment is now manufactured "in large quantities in this country and Norway." (1).

Particular attention has been directed to these titanium white pigments by the appearance of two papers—one titled "Titanium White: Its Production, Properties, and Use," by Messrs. W. H. Washburn and J. McGougan in the Proceedings of the Paint & Varnish Society (Session 1920-21, No. 3, p. 41 to 61); and the

(1) Paper by Andrew Thompson, General Manager, The Titanium Alloy Manufacturing Company, Niagara Falls, N. Y.

other, an article on the same subject, by Mr. Noel Heaton in the Journal of the Royal Society of Arts. (Vol. LXX, No. 3,631, for June 23, 1922, pp. 552 to 565). "There is little doubt that this new pigment has very valuable properties and an attractive future before it. It must, however, be made clear at this stage that the brands of "titanium white" pigment on the market consist normally of about 25 per cent of pure titanium dioxide mixed with 75 per cent of barium sulphate (barytes). In some cases, owing to the extreme chemical inertness of the titanium dioxide in the vehicle (usually linseed oil) it has been necessary to add considerable amounts of zinc oxide.

It is claimed for titanium white pigments that it is of (1) dazzling whiteness; (2) it consists of particles of exceeding fineness (3) it is light in weight; (4) of great permanence, owing to its inert; ness, either by exposure to acid fumes, fierce glare, or sea water; (5) it is non-poisonous; (6) weight for weight it is said to have nearly three times the obscuring power (opacity) of white lead; and (7) owing to the above qualities it works well, spreads more evenly, and is more durable than any other white paint. The above remarks apply to "titanium white)" as distinct from pure titanium dioxide. The drawback has been the great cost of this pigment, the "Standard" quality of the Titan Co. being recently quoted a £50 c. i. f. British port, packing included. The "Extra" quality, containing more titanium dioxide, is quoted at £75 a ton.

The raw material from which the pure titanium dioxide is prepared are the minerals rutile and ilmenite." (1)

FELDSPAR

The shipments of feldspar from Quebec mines in 1922 amounted to 12,472 tons valued at $115,483, an increase of 27% in tonnage and of 30% in value.

Reports of production were received from five operators, but development work was carried on by three others.

The principal operator was, like last year, Messrs. *O'Brien and Fowler*, owners of the Derry quarry on lots 7 and 8 range I of Derry township. This quarry was briefly described in our report

(1) Developments in the manufacture of Titanium Dioxide. The Min. Journal, London, Nov. 11th 1922, p. 841.

for 1921. Improvements in the quarrying equipment were effected during the year. The steam piston-drills have been replaced by Waugh air-drills, which required the installation of a compressor.

Messrs. Parker and Higginson, of Buckingham, who had opened a promising feldspar deposit on lot 9, range II of the township of Derry under the name of Buckingham Feldspar Company, sold their interests to Messrs. *Mahoney and Rich* of Ottawa, who carried on operations during the second half of the year. The production of this quarry under both operators was second in importance in 1922. The quarry is four miles distant from the river, by which the feldspar is shipped to Buckingham in barges. This has necessitated the construction of 2½ miles of road. Hauling to the river is done by teams and also by a caterpillar tractor which can haul three heavy trucks specially built, of a total maximum capacity of 35 tons.

Mr. *Bush Winning* made substantial shipments of dental spar, used in the manufacture of artificial teeth, from lots 2 and 3, range IX of Portland East. Mr. *Gonzague Pedneaud*, produced feldspar and quartz from his quarry on lot 14, range XII of Buckingham. The quartz was used by the Electric Reduction Co., at Buckingham.

Considerable work was done by the *St. Lawrence Feldspar Company, Ltd.*, who acquired the large feldspar deposit at Quatechou-Manicouagan Bay, on the North shore of the St. Lawrence. A shipping dock has been built, and the company expects to start shipping feldspar in 1923. Mr. S. E. Melkman is managing-director of the company who acquired all the properties and rights of the British-Minerals Corporation.

KAOLIN

After a period of quiescence which followed a period of experimentation in 1919 and 1920, work was resumed on the china clay deposits of Amherst township, in April 1921, under the direction of Mr. Alexander H. Smith, mining engineer, and development has been pushed actively since then, throughout the whole of the year 1922.

The shipments of kaolin in 1922 amounted to 1,296 toms

valued at $18,532, of which 1,196 tons were washed white china clay, and 100 tons were stained kaolin used as fire clay.

After numerous vicissitudes the china clay industry at St. Rémi is now giving better promises of success than at any time since the discovery of the deposits.

The *Canadian China Clay Company, Ltd.*, which is the eldest in this field, has been operating since 1912, when it acquired the properties and rights of the St. Rémi Kaolin Co., on lots 5 and 6, range VI South, of Amherst township. The past operations of this company have been noted in the reports on mining operations for 1914 and following.

During the latter part of 1921 and throughout 1922, considerable new development work was effected on these kaolin deposits. The length of prospecting drifts and cross-cuts totals to 1,250 feet. This work has blocked out a large quantity of white kaolin, containing an average of about 50% of white quartz sand. The method of mining adopted is to bring the crude clay into solution underground, and to pump this thin pulp from a sump situated in the main drift, to the surface. The method of mining is very ingenious and is really underground hydraulicking. The pump installed is a three inch two stage Morris Centrifugal sand pump, direct connected to a 60 H.P. electric motor. The capacity of the pump, at 1,200 r. p. m. would be 300 gallons a minute, containing 10% of solid matter. The thin pulp from the pump goes into a settling cone, eight feet in diameter, in which the coarse sand drops to the bottom and the clay and fine sand in suspension overflows with the water into two sets of troughs each 1,000 feet long, along which the fine sand falls and settles on the bottom, and the jet of water holding the clay goes to eight large settling tanks, the largest of which measures 75x62x7 feet. After drawing off the top liquid, the settled pulp which now holds 30% china clay, is pumped to filter-presses under a pressure of 100 lb. per square inch. The filter-cakes, which contain about 25% moisture, are placed on racks, and wheeled in cars, into a drying chamber, through which circulates a current of hot air. When completely dry, the cakes are broken up and put in the bin, ready for the market.

The kaolin deposits seem to occupy a belt or zone, which had been traced from lot 2 to lot 8 of range VI S. Amherst township. In the spring of 1922, *Mr. J. C. Broderick*, started prospecting and

development work on the extension of this belt towards the South, and has observed the presence of china clay on lots 11 and 12 of the same range, which he is now developing. He has put up a preliminary plant for mining and washing. Work was discontinued for the winter months, but will be resumed in the spring.

Dr. M. E. Wilson, of the Geological Survey of Canada, has made an examination of these kaolin deposits, and has published in 1919 a report on them, entitled Geology and Mineral Deposits of a Part of Amherst township, from which the following extracts are taken:

KAOLIN, KAOLINIC QUARTZITE, AND CORNISH STONE (1)

History of Development

In the summer of 1894, Milion Thomas, while digging a well on the farm of Philibert Tassé, encountered kaolin at a depth of 15 feet and sent a small quantity of the material to Richard Lanigan of Calumet, who identified the sample as kaolin and purchased the right to mine the material from the owner of the property. No attempt was made to determine the extent of the deposits at that time, however, and it was not until 1911 that actual development work on the deposits was commenced.

In the autumn of 1909, Mr. F. R. Lanigan, of Montreal, acquired from the Government the mining rights to parts of lots 4, 5, 6, 7, and 8, range VI south, Amherst township, and in 1911, having leased these rights to Mr. J. C. Broderick, of Montreal, formed the St. Rémi Kaolin Company, to take over the ownership of the property. In 1911, some development work was performed and the construction of a washing plant begun by Mr. Broderick and in 1912, the Canadian China Clay Company was organized to continue mining operations under the terms of Mr. Broderick's lease. In 1913 the Canadian China Clay Company purchased the mining rights to parts of lots 4 to 8, range VI south, Amherst township, from the St. Rémi Kaolin Company; the mining rights to parts of lots 2 and 3 and additional parts of lots 2 to 8, range

(1) Geological Survey, Ottawa, Memois 113. M. E. Wilson. Geology and Mineral Deposits of a part of Amherst Township, Quebec.

VI south, Amherst township, from the government; and the surface rights to all these lots, from the local owners. Since that time the washing plant on the property has been enlarged, some trenching, stripping, and drilling for the purpose of developing the deposits completed, and several thousand tons of kaolin produced. Prior to 1916 the washed product had to be transported by wagon to Huberdeau, the terminus of the Huberdeau branch of the Canadian Northern railway, but in that year the railway was extended to the china clay deposits so that the cost of transportation from the mine has been greatly reduced.

DISTRIBUTION

Deposits of kaolin have been discovered in the St. Rémi district in two localities up to the present time, the principal occurrences in a zone approximately 1,000 feet in width extending in a north-northwest direction from lot 8 to lot 2, range VI south, Amherst township, and a single deposit occurring near Pike creek on lot 8, range IV, Amherst township. The latter deposit occupies a position almost directly on the continuation of the principal zone of deposits farther to the south and may be another outcrop on the same zone, but whether or not a connexion exists has not been determined since there are no rock exposures in the intervening distance.

GENERAL CHARACTER

Lots 2 to 8, range VI South, Amherst township. In the western part of range VI south, Amherst township, there is a north-south trending drift-covered ridge about one-half mile in width, which intervenes between rocky ridges of granite-syenite gneiss, and from which it is separated by well marked depressions. An examination of the bedrock surface exposed in outcrops and in the bottom of trenches, railway cuttings, and other excavations, shows that this ridge throughout nearly its whole extent is composed of vertical or nearly vertical beds of Grenville quartzite and garnet gneiss, which trend in a north-northwest direction, and that, whereas on the eastern slope of the ridge the quartzite is exceedingly massive and unbroken, on the western slope, throughout a zone approximately 1,000 feet in width, it has been shattered almost everywhere to a friable condition. Within the shattered zone

kaolin occurs, finely disseminated between the quartz grains, in veins following the planes of fracture and movement and in more extensive deposits up to 100 feet in width and several hundred feet in length. Owing to the presence of the thick overburden of glacial drift which nearly everywhere covers the ridge, the whole extent of the shattered zone in which the kaolin is found has not yet been determined but sufficient information has been obtained by means of trenches, test pits, and stripping, to indicate that the zone extends in a direction north 20 degrees west parallel to the structural trend of the quartzite, and is continuous for approximately 7,000 feet.

The most extensive deposits of kaolin so far discovered in this shattered zone are on lots 5 and 6, where an almost continuous lead of kaolin, ranging from a few feet to 100 feet in width, has been laid bare by stripping and test pits for a distance of 1,400 feet. Bore-holes on this deposit show that it persists to a considerable depth beneath the surface, a depth of 150 feet in kaolin having been attained at one point. Although the kaolin leads everywhere contain considerable quartzite either in the form of fragments or finely disseminated grains, the determination of the amount of kaolin contained in average samples shews that the kaolin content in the masses of kaolin as a whole is not less than 35 per cent.

Throughout other parts of the shattered zone numerous kaolin leads ranging from a fraction of an inch up to 65 feet in width have been discovered at several points where the drift cover has been removed from the bedrock surface. The deposits of this character so far discovered on the various lots are the following:

Lot 2	Leads 65 and 12 feet wide in trenches.
Lot 5, east of main deposit.	Leads 5, 21, and 1 foot wide in test pits.
Lot 5, west of main deposit.	Numerous leads from ½ inch to 4 feet in width.
Lot 6	Lead in excavation for spring.
Lot 7	Leads of kaolin ½ inch in width in broken kaolinic quartzite, exposed in cutting on Canadian Northern railway.
Lot 8	Half inch leads of kaolin, in broken kaolinic quartzite exposed in cutting on Canadian Northern railway.

Lot 8, range IV, Amherst township. At the east end of lot 8 range IV, Amherst township, kaolin is exposed in the bottom of a few small pits excavated on the bank of Pike creek. The material composing these deposits consists of grains of quartz, aggregates of kaolin, and rusty zones containing disseminated flakes of muscovite. The distribution of these constituents is remarkably similar to that of the constituents composing the granite-gneiss of the region, the quartz grains occurring disseminated in a manner similar to quartz grains of the granite, the kaolin similar to the feldspar, and the rusty zones similar to the ferromagnesian constituents. It seems probable, therefore, that this deposit has been formed by the alteration of granite-gneiss.

REPLACEMENT

The evident association of the kaolin deposits of the St. Rémi district with a zone of faulting and fracture and the occurrence of masses of kaolin in the deposits, forming a matrix enclosing broken masses of quartzite, would seem to indicate that the kaolin deposit had been formed entirely by the deposition of kaolin in openings resulting from the deformation of the Grenville quartzite; but there is also much evidence to indicate that large masses of kaolin have been deposited by replacement, that is the quartzite adjoining the planes of faulting and fracture has been carried away in solution by circulating waters and kaolin deposited in its place. The principal observations on which this conclusion is based are: (1) that the surfaces of the quartzite beds adjoining the planes of bedding are channeled and pitted with caverns in which the kaolin has been deposited; (2) that beds of quartzite remain in their original vertical attitude here and there within the kaolin deposits; (3) that the bedded structure of the quartzite is preserved in the kaolin deposits in places; (4) that the quartz grains contained in the quartzite have a marked vertical elongation and this elongation is preserved by the quartz grains contained in the kaolin even where the kaolin constitutes 75 per cent of the deposit.

COMPOSITION

In the northern part of the fracture zone, the kaolin deposits consist almost entirely of white to cream white kaolin and quartz,

other constituents being either uncommon or only local in their occurrence; in the southern part of the zone, on the other hand, the greater part of the outcrop so far disclosed by stripping operations is coloured in various shades of red, brown, and yellow from the presence of disseminated hydrous iron oxide, but whether this is merely a superficial discoloration or persists in the deposits at depth has not yet been determined. The uncommon impurities observed in the kaolin deposits are fine flakes of muscovite, aggregates of tourmaline, and disseminated flakes and aggregates of graphite.

That the normal white to cream white kaolin contained in the St. Rémi deposits is remarkably free from impurities is indicated by the analyses of the washed product, included in columns I and II of the following table:

ANALYSES OF KAOLIN FROM AMHERST TOWNSHIP, COMPARED WITH ANALYSES OF KAOLIN FROM OTHER COUNTRIES

	I	II	III	IV	V
Silica	46.13	44.43	46.17	47.10	45.78
Alumina	39.45	40.48	38.42	39.42	36.46
Ferric iron	0.72	0.039	0.43	0.23	0.28
Ferrous iron					
Lime	none	0.24	0.09	0.31	0.50
Magnesia	none	0.36	0.04	0.24	0.04
Potash	0.20		2.77	0.16	0.25
Soda	0.09			0.08	
TiO_2				0.13	
Loss on ignition	13.81	14.46	12.01	12.24	13.40
Moisture	.....	.....	.....	.....	2.05
Total	100.40	100.01	99.93	99.91	98.84

I. St. Rémi, Amherst township, Labelle county, Quebec. Analysis by G. F. Lundell.

II. St. Rémi, Amherst township, Labelle county, Quebec. Analysis by Milton Hersey Company, Can Min. Journal, vol. 33, 1912, p. 441.

III. Jackson, W. and Richardson, A. G., Trans. Eng. Ceramic Soc. vol. 3, 1903, p. 56.

IV. Mellor, J. W. and Holdcroft, A. D., Trans. Eng. Ceramic Soc., vol. 10, 1922, p. 94.

V. North Carolina, Geol. Surv., Bul. 13, 1897.

ORIGIN

It has been pointed out, in the sections of the report in which the structural features of the kaolin deposits and the evidences of replacement which they exhibit were discussed, that the kaolin leads occur in association with a wide zone of faulting and fracture traversing Grenville quartzite and have been formed partly by the deposition of kaolin along the planes of fracture and faulting and partly by replacement of the friable quartzite wall rock. The association of the kaolin deposits with a zone of fracture and faulting is of considerable economic importance, since the horizontal extent of the deposits is directly related to the extent of the zone or zones of deformation. It is equally important, however, from a commercial standpoint, that the source from which the kaolin was derived be determined; for, if the kaolin has been carried down into the zone of deformation from a superficial source, the deposits may disappear before the depth to which mining operations might be carried on is reached; on the other hand, if the kaolin has been derived from a deep-seated source, it is reasonably certain that the deposits persist to depths beneath the limit to which the kaolin could be profitably mined.

St. Rémi Deposits

The kaolin deposits of St. Rémi district are peculiar in that the most extensive leads do not occur in association with highly feldspathic rocks but with quartzite, so that the kaolin in these occurrences has been transported along the planes of fracture and faulting from an extraneous source either above or below the present location of the deposits.

Kaolin from a superficial Source.—There are two possible superficial sources from which the kaolin may have been derived. These are the quartzite-garnet gneiss belt in which the kaolin deposits are found, and the batholithic masses of granite and syenite gneiss which adjoin the quartzite-garnet gneiss belt.

The Grenville quartzite with which the kaolin deposits are associated generally contains sparsely disseminated feldspar, is intruded in places by dykes of granite or syenite, and includes beds of garnet gneiss; and since granite, syenite, and garnet gneiss all

contain an abundance of orthoclase, it is possible that the kaolin deposits have been formed from feldspar by downward concentration along the planes of faulting and fracture as the upper parts of the zone of deformation weathered away. As far as known at present, however, the proportion of feldspar contained in the quartzite and garnet gneiss, including all its modes of occurrence, is small, and unless the proportion contained in the unexposed portions of the belt is larger than the exposed portion, the concentration of the kaolin deposits would require the weathering away of an enormous thickness of rock. Thus, if the quartzite-garnet gneiss belt contains an average of 5 per cent of orthoclase, and the zone of fracture and faulting, in which the kaolin occurs, contains an average of 20 per cent of kaolin to a depth of only 100 feet, the concentration of this kaolin by downward enrichment would involve the weathering away of nearly 800 feet of rock, and 8 tons of silica, and other impurities would have to be carried away in solution for every ton of kaolin produced.

It is probable that prior to the glacial epoch the surface of the batholithic granitic rocks of the Amherst area, like the unglaciated regions of North America at the present time, was covered with a thick mantle of weathered material, and that, as at the present time, the areas underlain by these rocks stood at a higher elevation than the belt of quartzite in which the kaolin is found. It is possible, therefore, that the kaolin in the St. Rémi deposits may have been derived from the weathering product overlying the feldspathic rocks of the district, but this would involve the horizontal transportation of the kaolin for at least several hundred feet and it is doubtful whether the kaolin contained in the St. Rémi deposits would have remained so remarkably pure if it had been transported this distance.

Kaolin from a Deep-seated Source.—Since the quartzite garnet gneiss belt, in which the St. Rémi kaolin deposits are found, lies between batholithic masses of granite and syenite gneiss, and these are merely parts of a huge massif extensively developed in this part of the Laurentian highlands, it is probable that the zone of fracture and faulting along which the kaolin is found intersects granite or syenite at depth. It is possible, therefore, that thermal solutions ascending along the fault plane might kaolinize the feldspar of the granite or syenite and then transport the resulting alteration pro-

duct upward, redepositing it in the quartzite above. The principal evidence observed in the study of the kaolin deposits, that might have a bearing on this hypothesis, was the presence of sericite and aggregates of black tourmaline in the kaolin and in the quartzite wall rock. Where tourmaline crystals occur in the quartzite, it was observed that these generally seemed to lie on the surface of bedding planes or other openings where circulating waters had penetrated, and in no case extended very far into the solid rock. It seems apparent therefore, that the tourmaline was deposited after the quartzite was fractured and faulted, and that highly heated aqueous or gaseous solutions at some time circulated through the fracture zone.

Conclusion. From the preceding discussion it is concluded that, as far as the writer was able to observe, evidence from which a definite conclusion with regard to the origin of the St. Rémi kaolin deposits may be inferred, is not yet available. Nevertheless, there are certain features exhibited by the deposits that have definite bearing on the problem. These are: that the kaolin occurs in a zone of fracture and faulting, traversing Grenville quartzite and garnet gneiss; that the principal kaolin leads so far discovered occur in quartzite and hence the kaolin has not been developed *in situ* but has been transported into its present position; and that the relationships of the kaolin in places show that it has been deposited in part by the replacement of the quartzite wall rock. Whether the kaolin originated by superficial weathering and was carried down into the fracture zone, or was brought up from below by thermal waters, the writer is unable to decide. The presence of crystals of tourmaline, a mineral formed at high temperatures, indicating that thermal waters at some time circulated through the fault zone, might seem very positive evidence in favour of the deep-seated origin of the kaolin; on the other hand, the occurrence of oxidized and kaolinized garnet gneiss at a depth of 85 feet in the shaft recently sunk on the property of the Canadian China Clay Company is possibly equally positive evidence favouring the derivation of the deposits from a superficial source.

SOAPSTONE

At the end of December 1921, Mr. Louis Cyr, of Thetford Mines, acquired the quarrying rights on lot 4, range V of Thetford

township, for the purpose of working a deposit of soapstone, to make soapstone brick or blocks.

Soapstone blocks are used for lining alkali recovery furnaces in the pulp mills using the sulphate process. The main requirements of the lining are that it should remain unfused at a temperature of 2000 degrees Far. and resist fused sodium sulphide. Chrome bricks and talc blocks fulfill these conditions, but the talc, or soapstone, is much less expensive than the chrome, although it does not last as long.

Mr. Louis Cyr has initiated the production of these talc blocks to supply the paper mills of the province, and the products he has put out have proved very satisfactory. The soapstone is easily cut into blocks by means of circular saws run by a gasoline engine. The main demand is for blocks measuring 6x6x12 inches and 6x6x18 inches. Mr. Cyr is now supplying paper mills at East Angus and Three Rivers.

MOLYBDENITE

There has been no new developments in the Quebec molybdenite industry during 1922, and the work done on molybdenite deposits during the year has not been important.

A company, the *Molybdenite Reduction Co.*, was organized to take over the Benjamin properties in La Corne township, and this was the only deposit in the province on which a little development work was done. It is possible that the large stocks which accumulated during the last year of the war have not yet been absorbed.

However, great progress was made in the investigations of the use of molybdenum as an alloying element in steel, begun in 1921 by the United States Bureau of Mines, in cooperation with the Vanadium Corporation of America. They were continued throughout 1922. This work is carried on at the Ithaca station of the U. S. Bureau of Mines, in charge of Dr. H. W. Gillett.

It may be added that the molybdenum alloys, more especially in conjunction with nickel and chromium, are finding a growing application in the automotive industry.

There appears to be a promising future for molybdenum steels, and as its metallurgy is studied and investigated, the practical applications and uses of these steels will develop and stabilize. The manufacture of tungsten steels was initiated about 1860, but it

was really only at the beginning of the twentieth century that the uses of tungsten steels developed to any extent. When it is remembered that the industrial metallurgy of molybdenum is barely twenty years old, the progress made has been much more rapid than for tungsten.

BUILDING MATERIALS

(A. O. Dufresne)

After a period of quietness in 1921 it is gratifying to note a resumption of activity for the year 1922, as shown by the figures of production.

The value of the building materials for 1922 was $11,760,508, as compared with $9,888,811 in 1921, an increase of 19%. Moreover it may be noted that the increase in value would have been much greater had the prices which ruled in 1921 held in 1922. For instance the average price of cement fell from $2.53 a barrel to $2.22; lime from $11.37 a ton to $8.25; road metal was also appreciably lower. If the average price per ton was greater it is because the proportion of dressed stone was much greater than last year. However the average price of common brick only shows a very slight decrease, whereas that of pressed and fancy brick shows a substantial advance.

For the first time since statistics have been collected no roofing slate was produced from the quarries in Melbourne township. The quarry of the New Rockland Slate Co. was closed in May 1921 and has not produced since. The figures of slate production in the general table represent crushed slate, red and green, used in the manufacture of roofing paper. The *Slate Products of Canada, Ltd.*, has a crushing and screening plant on lot 14, range IV of Melbourne. This deposit of green slate is worked as a quarry. The excavation is 80 feet by 35 feet in area and 45 feet deep. The rock is hoisted to the top of the plant by an incline, in skips which hold two tons of rock. The slate is cruhed in two stages. It is first dumped into a gyratory crusher, Allis Chalmers No. 4, and then passes through two No. 2 Austin gyratories, and goes to a 150 ton bin. It is drawn from the bin to a screen sloping 45°, the frame of which rests on springs, on which a cam acts, giving 100 vibrations a minute. The fines are rejected, and the coarse goes to crushing rolls, and over a second

screen, then to a storage bin. The capacity of the plant is 75 tons a day.

The second crushed-slate mill is that of the *British Canadian Marble Co. Ltd.*, at St. Joseph de Beauce. This Company operates a wide band of red and green slate. During the summer the work was mainly construction and changes in the mill. A 1,000 ton storage bin was built along a spur line of the Quebec Central Railway at a distance of three-quarters of a mile from the plant. The mine and the mill resumed operations in September. An underground method is used for the mining of the slate. A vertical shaft 60 feet deep was sunk, 11 feet x 6 feet, divided into two compartments, 4½ by 4½ feet each, inside measurements. From the bottom of the shaft two drifts 100 feet long each were driven in the band of red slate. A cross-cut 100 feet was also driven. At right angles to this cross-cut three other drifts were opened. The first is 16 feet from the shaft, and is 40 feet long; the second and the third are at 70 feet, and are in opposite directions to each other. They are 20 feet long. The band of red slate is 10 to 11 feet wide. Mining is by overhand stoping with chutes in the roof of the drift.

The crushing plant comprises a Wheeler No. 4 Jaw crusher, a 100 ton ore-bin, a dryer, a 20 x 30 inch set of rolls; a Sturtevant screen inclined 45°, whence the oversize is sent to a second set of rolls. The fines go to a finishing set of rolls 7 by 30 inches. The capacity of the plant is 40 tons per shift.

During the spring of 1922, the *Mystic Slate Co.* prospected and developed a slate deposit situated on Bert Watson's farm, lots 20 and 21, range VII, Stanbridge township, in Missisquoi county, north of Mystic Station. The slate is deep dark blue; the pit measures 45 feet by 10, and is 18 feet deep. Its length is across the strike of the slate, on the bottom of a sharp synclinal fold.

The brick plants have been active during the year, and the market and output have been very satisfactory. In Granby the plant formerly operated by Mr. Loiselle was purchase by the *Granby Clay Product Ltd.* The *Compagnie de Tuyaux de Drainage Ltée,* at l'Islet Station, manufactured hollow brick specially which were sold in Quebec city. During the summer, four brick yards were operated at St. Jean Deschaillons all under the control of *Mr. Lucien Laliberté.* The *National Brick Co.* at Laprairie made some successful experiments on the manufacture yellow brick, plain and speckled, and of dark brown brick.

Owing to the increasing demand for the products of the *Citadel Brick and Paving Blocks Co. Ltd.*, of Boischatel, near Quebec, this company at the end of the year was enlarging its plant to a capacity of 125,000 brick per day.

The *Métis Shale Brick Co. Ltd.*, at St-Octave-de-Métis, has begun manufacturing common brick for local use. The company owns one of the few deposits the shale of which can be used for the manufacture of vitrified brick.

The quantity of limestone produced from the quarries in 1922 has been about the same as for 1921. The proportion of dimension stone, however, has been appreciably higher. During the year several concerns were organized to undertake the cutting and dressing of stone; these are the Villeray Cut Stone Co. Ltd, Montreal Cut Stone Co. Ltd, both in Montreal; Laval Quarry Co. Ltd, at Cap St. Martin; Naud & Darvaud, at St. Marc des Carrières. The macadamizing of roads in the immediate vicinity of Quebec has been the cause of reopening quarries at Charlesbourg and at Château Richer.

Several sandstone quarries were operated during the year. The T. S. Kirby Company Ltd., worked its quarry at St-Simon in the county of Two Mountains, producing mainly paving blocks of Potsdam sandstone. In the Quebec city region, the Provincial Roads Department used Sillery sandstone, from Soresto, in Levis county, for the repairing and upkeep of the St-Henry road; for the macadamizing of St-Louis road, in the parish of Ste-Foye, sandstone was obtained from the old Sillery quarries on lot 320 and adjoining. These quarries are on the farms of J. B. Vézina and James Corrigan, on the south side of St-Louis road.

The Vézina quarry was opened on a large outcrop of green Sillery sandstone. Its face measures 300 feet in length and is 15 to 20 feet high. It is from this quarry that the stone used for the citadel walls, for the foundation of the Court House and of the Parliament Buildings; for the construction of the church of Notre-Dame du Chemin, and many other buildings in the city of Quebec was taken.—

LIST OF THE PRINCIPAL OPERATORS AND OWNERS OF MINES AND QUARRIES IN THE PROVINCE OF QUEBEC

ASBESTOS

Asbestos Corporation of Canada, Limited,
J. McCallum, Secretary, Thetford Mines, Que.
Asbestos Fibre Co., Inc.,
Black Lake, Que.
Asbestos Mines, Limited,
East Broughton, Que.
Asbestos Quarries, Ltd.,
Black Lake, Que.
Bell Asbestos Mines,
O. C. Smith, Manager, Thetford Mines, Que.
Bennett-Martin Asbestos and Chrome Mines, Limited,
Thetford Mines, Que.
Black Lake Asbestos and Chrome Co., Limited,
Black Lake, Que.
Canadian Johns-Manville Co., Limited,
Asbestos, Que.
Consolidated Asbestos, Limited,
Norman R. Fisher, Mgr., Thetford Mines, Que.
Federal Asbestos Company,
Robertsonville, Que.
The Frontenac Asbestos Mining Co.,
F. W. Ross, 92 St. Peter Street, Quebec City.
General Asbestos, Limited,
East Broughton, Que.
Guillemette, Donat,
Thetford Mines, Que.
Johnson's Company,
A. S. Johnson, Mgr., Thetford Mines, Que.
Lake Frontière Asbestos Company, Limited,
c/o Ludger Dionne, St. George Beauce Co., Que.
Maple Leaf Asbestos Corporation, Limited,
Thetford Mines, Que.
The Pennington Asbestos Company,
Thetford Mines, Que.
Quebec Asbestos Corporation,
E. E. Spafford, Mgr., East Broughton, Que.
Queen Asbestos, Limited,
St. Cyr, Richmond county, Que.
St. Adrien Asbestos Mines, Limited,
St. Adrien de Ham, Que.

CHROME

Bennett-Martin Asbestos and Chrome Mines, Limited,
Coleraine, Que.
Black Lake Asbestos & Chrome Co., Limited,
Black Lake, Que.
Dominion Mines & Quarries, Limited,
Canada Life Building, Toronto, Ont.

Quebec Chrome Corporation, Ltd.,
Black Lake, Que.
Victory Chrome Mines, Ltd.,
103 St. François Xavier, Montreal.

COPPER

Eastern Mining & Milling Co., Limited,
Eastman, Que.
Eustis Mining Company,
F. M. Passow, Manager, Eustis, Que.
Geo. E. Smith,
823 St. Antoine St., Montreal.
Weedon Mining Co., Limited,
L. D. Adams, Pres., 201 Bank of Nova Scotia Bldg., Montreal.

DOLOMITE

White Grit Company,
Portage du Fort, Que.

FELDSPAR

J. H. Cameron,
Buckingham, Que.
Masson, W. G.,
72 Spark St., Ottawa.
Mahoney and Rich,
Buckingham, Que.
A. J. MacMillan,
Buckingham, Que.
O'Brien & Fowler,
114 Wellington St., Ottawa.
Gonz. Pedneaud,
Glen Almond, Que.
St. Lawrence Feldspar Co., Ltd.,
Thelmina, Que.
Watts and Noble,
Kirks Ferry, Que.
Bush Winning,
N.-D. de la Salette, Que.

GOLD

John Dalton,
Timmins Ont.
Eustis Mining Co.,
Eustis Que.
Kienawisik Mines Limited,
Amos Que.
The Kienawisik Gold Mining Co., of Portland, Maine,
15 Congress St. Boston Mass.
The Lake Fortune Mining Co., Limited,
227 Lemoine St. Montreal.
Martin Gold Mining Co.,
Amos Que.
Northern Quebec Goldfields and Exploration Co.,
Three Rivers Que.

Siscoe Mining Syndicate,
Amos, Que.
La Société Minière Canadienne,
Ville-Marie, Que.
Stabell Gold Mines, Ltd.,
c/o J. S. Lette, Amos, Que.
Union Mining Corporation, Ltd.,
c/o A. C. Brown, Timmins, Ont.

GRAPHITE

Laurentian Graphite, Limited,
St. Rémi d Amherst, Que.
North American Graphite Co., Ltd.,
Buckingham, Que.
North Quebec Mining Development Company, Limited,
Gédéon Frédette, St. Rémi d'Amherst, Que.
Plumbago Syndicate,
Excelsior Life Bldg., Toronto.
Quebec Graphite Co., Limited,
R. C. Rowe & C. N. Daly, Managers, Buckingham, Que.
The Standard Graphite Company, Limited,
Guenette, Que.

IRON & TITANIC IRON

American Titanic Iron Co.,
J. H. Boisvert, Parliament Bldg., Quebec City.
Baie St. Paul Titanic Iron Ore Co.,
J. O. Paré, Manager, Baie St. Paul, Charlevoix, Co., Que.
The Loughborough Mining Co., Limited,
Sydenham, Ont.
Manitou Iron Mining Co.,
c/o J. E. Wilder, 323 Bleury St., Montreal.

KAOLIN

J. C. Broderick,
Huberdeau, Que.
The Canadian China Clay Co., Limited,
Huberdeau, Que.

MAGNESITE

J. F. Inglee,
94 Binscarth Road, Toronto.
International Magnesite Co., Limited,
Calumet, Que.
North American Magnesite Producers, Limited,
Calumet, Que.
Scottish-Canadian Magnesite Co., Limited,
P. O. Box 50, Grenville, Que.

MARL

Canadian Whiting Co., Ltd.,
St. Jérôme, Qué.

MICA

W. Ahearn, Jr.,
538 McLaren St., Ottawa.
Wm. Argall,
Laurel, Que.
Blackburn Brothers,
Union Bank Bldg., Ottawa.
Brown Brothers,
Cantley, Que.
Calumet Mica Co.,
Campbell's Bay, P. Q.
Capital Mica Co., Limited,
W. Ahearn, Manager, St. Pierre de Wakefield, Que.
Chabot & Co.,
124 Rideau St., Ottawa.
Cross & Wilson,
Cascades, Hull Co., Que.
Dougherty Brothers,
Wakefield, Que.
H. T. Flynn,
106 Montcalm Street, Hull, Que.
J. B. Gauthier,
Box 226, Buckingham, Que.
J. B. Gorman,
Box 166, Buckingham, Que.
Wm. Gowan,
Holland Mills, Que.
The Laurentide Mica Company, Ltd.,
119 Queen Street West, Ottawa.
The Loughborough Mining Co.,
N. J. Sproule, Manager, c/o G. W. McNaughton, Sydenham, Ont.
A. G. Martin,
236 Besserer St., Ottawa.
McGlasham Mining Syndicate,
Cantley, Que.
J. B. Nault,
Rivière Desert, Que.
O'Brien & Fowler,
114 Wellington St., Ottawa, Ont.
The Perkins Mills Mining Co.,
c/o P. Laurin, Pointe Gatineau, Que.
Sherbrooke-Saguenay Mica, Limitée,
136 King St. W. Sherbrooke, Que.
Wallingford Bros. Limited,
Perkins, Que.
Wallingford Mica & Mining Co.,
Banque Nationale Bldg., Ottawa, Ont.
Edward Watts,
158 Wellington St., Hull, Que.
Wilson, S. C.,
Cascades, Que.
Winning Mica Syndicate,
Notre-Dame de la Salette, Que.

MINERAL WATER

Abenakis Springs Company, Limited,
W. E. Watt, Manager, Abenakis Springs, Que.

Eaux Minérales Naturelles de St. Vallier, Enrg.,
S. Vallier, Bellechasse Co., Que.
Alfred Ferland,
Village St. Benoit, Two-Mountains Co., Que.
Radnor Water Co., Limited,
Lewis Bldg., Montreal, Que.
Cyprien Roy,
St. Germain, Kamouraska Co., Que.
D. Veillet & Cie.,
Ste. Geneviève, Batiscan Co., Que.

MOLYBDENITE

Dominion Molybdenite Co., Limited,
M. L. Foley, 12 Maynard Ave., Toronto.
The Height of Land Company,
S .P. Wilon, Mgr., 316 St. James St., Montreal.
Molybdenite Reduction Co., Ltd.,
52 St. James Street, Montreal.
St. Maurice Mines Co., Ltd.,
c/o W. J. Haines, 1011 Chesnut St., Philadelphia, Pa.

OCHRE AND IRON OXIDE

Argall's Oxide Mines,
P. O. Box No. 5, Three Rivers, Que.
Canada Paint Co., Limited,
Jos. Bradley, Manager, Red Mill, Que.
Canadian Oxides & Ochres,
L'Ascension, Labelle Co., Que.
The Champlain Oxide Co.,
Lucien Carignan, Manager, Three Rivers, Que.
Montmorency Paint Products Co., Ltd.,
132 St. Peter Street, Quebec city, Que.
François Ouellet,
Ste-Gertrude Nicolet Co., Que.
Paint River Oxide Co., Reg'd.,
P. O Box 144 Station B. Quebec city, Que.

PEAT

La Compagnie de Tourbe Ltée,
Montréal.

PHOSPHATE

Blackburn Bros.,
H. L. Forbes, Manager, Union Bank Bldg., Ottawa.
J. G. Higginson,
Buckingham, Que.
O'Brien & Fowler,
114 Wellington St., Ottawa.
Wallingford Bros., Limited,
Perkins, Que.
Edward Watts,
158 Wellington St., Hull, Que.

SILICA, ROCK AND SAND

J. Bonnell,
Buckingham, Que.

The Canadian China Clay Co., Limited,
Huberdeau, Que.
Consolidated Sand Company,
270 Ottawa St., Montreal.
J. B. Gorman,
Box 166, Buckingham, Que.
G. Pedneaud,
Glen Almond, Que.
A. Sicard,
St. Canute, Que.
Silico, Limited,
103 St. François Xavier, St. Montreal.
Temple Silica Sand, Ltd.,
East Templeton, Que.

SILVER

Eustis Mining Co.,
F. M. Passow, Manager, Eustis, Que.
Weedon Mining Company,
L. D. Adams, President, Weedon, Que.
Estate Pierre Tetreault,
4300 Notre Dame St. East, Montreal.

TALC

Louis Cyr,
Leeds, Que.
Canada Paper Co., Ltd.,
Windsor Mills, Que.
J. N. Martel,
Belmina, Wolfe Co., Que.
Geo. R. Pibus,
Knowlton, Que.
The Robertsonville Soapstone Quarry Co.,
Robertsonville, Que.
C. V. M. Temple,
175 Spadina Road, Toronto.

ZINC AND LEAD

Federal Zinc and Lead Co., Ltd.,
602 Drummond Bldg., Montreal, Que.
The New Richmond Mining Co.,
New Richmond, Que.
North America Mining Co.,
New Carlisle, Que.
Estate Pierre Tetreault,
4300 Notre Dame St., East, Montreal, Que.

BRICK

Ascot Tile & Brick Co., Limited,
Ascot Corner, Que.
Brompton Clay Hills, Inc.,
Bromptonville, Que.
The Citadel Brick & Paving Block Co., Limited,
P. Galarneau Manager, 421 St. Paul St., Quebec City.
La Compagnie de Briques de l'Abitibi,
Amos, Que.

La Compagnie de Briques de Deschaillons,
Deschaillons, Que.
La Compagnie de Briques de l'Islet, Ltée,
L Islet, Station, Que.
La Compagnie de Briques de Matane,
St. Jérôme de Matane, Qué.
Jos. Desrochers,
Warwick, Que.
Granby Clay Products, Limited,
P. O. Box 266, Granby, Que.
David F. Hodgins,
Shawville, Que.
L'Industrielle St. Tite, Limitée,
St. Tite, Champlain Co., Que.
Emile Longpré,
St. Félix de Valois, Que.
The Alex. Mills Brick Co., Reg'd.,
Ormstown, Que.
The Metis Shale Brick Co., Limited,
St. Octave de Métis, Qué.
National Brick Co. of Laprairie, Limited,
511 St. Catherine St. West, Montreal.
Paradis & Létourneau,
Stadacona, Quebec City.
Proulx Brothers,
Richmond, Que.
The St. Lawrence Brick Co., Limited,
71 St. James Street, Montreal, Que.

CEMENT

Canada Cement Co., Limited,
F. P. Jones, Manager, Canada Cement Co. Bldg. Montreal.

GRANITE

Aug. Bernier,
Roberval, Que.
Louis Bertrand,
Shawinigan Falls, Que.
Brodies, Limited,
128 Bleury Street, Montreal.
Joseph Brunet,
663 Côte des Neiges Road, Montreal.
La Carrière Bussière, Limitée,
St. Sebastien, Que.
Jos. Cloutier,
Beebe, Que.
La Compagnie de Granit de Charlesbourg, Limitée,
Room 309, Merger Bldg, Quebec City, Que.
Augustin Delisle
Rivière-à-Pierre Que.
Albert Desrosiers,
Beebe Jct., Que.
Dumas & Frère,
Rivière-à-Pierre, Que.
William Duncan,
Graniteville, Que.
Jobin & Genois,
Rivière à Pierre, Que.

J. C. Lacasse,
Beebe, Que.
Alphonse Lacroix,
St. Sebastien Station, Que.
James McKenzie,
Graniteville, Que.
Mitchell & Williams,
Beebe, Que.
Mountain Granite Co.,
Beebe, Que.
Philippe Nadeau,
St. Samuel, Que.
S. B. Norton,
Beebe, Que.
Arthur Perron,
Rivière-à-Pierre, Que.
Mr. Jos. N. Perron,
Rivière-à-Pierre, Que.
Stanstead Granite Quarries Co., Limited,
Beebe Jct., Stanstead, Co., Que.
M. Tilton,
Beebe, Que.
Vachon, Rodrigue & Frère,
St. Samuel Station, Que.
F. Voyer & Frère,
Rivière à Pierre, Que.

LIME

Arnaud & Beaudry,
Joliette, Que.
Adolphe Barron,
St. Dominique, Bagot Co., Que.
Delphis Beauregard,
North Stukely, Que.
Arthur Boivin,
Pont Rouge, Portneuf Co., Que.
R. B. Carswel ,
Bryson, Que.
Dominion Lime Co.,
Sherbrooke, Que.
Octave Fortin,
Val-Brillant, Que.
Octave Héon,
St. Louis de Champlain, Que.
Barthelemy Juteau,
St. Thérèse de Blainville, Que.
The Laurentian Stone Co., Ltd.,
Hull, Que.
Magloire Leclerc,
St. Dominique, Que.
Thos. McCambly,
Kazubazua, Que.
Montreal Lime Co.,
31 Prenoveau St., Montreal.
Francis Naud,
St. Marc des Carrières, Que.
Placide Sanche,
Ste. Thérèse, Que.

Sovereign Lime Works, Limited,
Delorimier Ave. and C. P. R. Tracks, Montreal.
Standard Lime Co., Limited
St. Paul, Joliette Co., Que.
St. Maurice Lime Company, Limited,
P. O. Box 479, Trois Rivières, Que.
Succession Olivier Limoges,
40 Poupart St., Montreal.

LIMESTONE

J. W. Baker,
Chateau Richer, Que.
Bathurst Company, Ltd.,
Port Daniel, Que.
Pitro Beaudry,
rue Taché, Joliette, Que.
L. O. Bergevin,
Chambly Canton, Que.
William I. Bishop. Limited,
10 Catheart St., Montreal.
Canada Carbide Company, Limited,
Power Building ,Montreal.
La Cité de St. Hyacinthe,
St. Hyacinthe, Que.
La Cité de Hull,
Hull, Que.
Alderic Cousineau,
2455, St. Urbain Street, Monytreal.
The Delorimier Quarry Co.,
1952 Iberville St., Montreal.
Deschambault Quarry Corporation,
52 St. Paul St., Quebec City.
The Deschambault Stone Co., Limited,
St. Marc des Carrières, Que.
Cyrille Durocher,
5383 Notre Dame St. East, Montreal, Que.
Estate Pierre Tetreault,
4300 Notre Dame St. East, Montreal.
The Federal Stone & Supply Co, Limited,
339 Queen St., Ottawa.
Georges Fleury,
Charlesbourg Ouest, Que.
Martin Gagnon,
3595 St. Hubert St., Montreal.
Gaspesian Fertilizer Co., Reg.,
Port Daniel East, Que.
Olivier Gauthier,
St. Marc des Carrières, Que.
E. L. Gravel,
Chateau Richer, Que.
Institution des Sourds-Muets,
3600 St. Lawrence St., Montreal.
F. X. Jobin,
Charlesbourg, Que.
Joliette Castings & Forgings Ltd.,
Joliette, Que.
The Kennedy Construction Co., Limited,
310 Shaughnessy Bldg., Montreal.

Laganière, Houde & Cie,
319 St. Paul Street Quebec City.
Joseph Lapointe,
74 Montée St. Laurent, Cartierville, Que.
Laval Quarry Company Ltd.,
Cap St. Martin, Que.
Edgar Lawrence,
Port Daniel, Que.
Victor Lecrenier,
Cap St. Martin, Laval Co., Que.
The Mahoney & Rich Quarries, Limited,
88 Bank St., Ottawa, Ont.
Maisonneuve Quarry Co., Limited,
2855 Boulevard Rosemont, Montreal.
O. Martineau & Fils, Limited,
371 Marie Anne Ave. East, Montreal.
R. H. Miner & Co., Ltd.,
Suite 2—207 St. James Street, Montreal.
Montreal Crushed Stone Co., Ltd.,
590 Union Ave., Montreal.
Montreal Cut Stone Ltd.,
800 Bellechasse St., Montreal.
Montreal Quarry Limited,
800 Bellechasse St., Montreal.
Naud & Darveau,
St. Marc des Carrières, Que.

Jos. D. Naud,
St. Marc des Carrière, Que.
O'Connor Brothers,
Huntingdon, Que.
Joseph Pagé,
Charlesbourg Ouest, Que.
F. X. Pageau,
Charlesbourg Village, Que.
Jos Poulin,
Chateau Richer, Que.
John Quinlan & Co.
1165 Greene Ave., Westmount, Que.
Richelieu Quarry, Ltd.,
St. John, Que.
Estate Thomas Rogers,
1701 Iberville Street, Montreal.
A. Simard,
Chambly, Que.
The St. Laurent Quarry, Limited,
Cap St. Martin, Laval Co., Que.
Standard Lime Co., Limited,
Joliette, Que.
C. E. Stangar,
East Templeton, Que.
Stinson-Reeb Builders' Supply Co., Ltd.,
45 Alexander St., Montreal, Que.
Magloire Théoret,
Valleyfield, Que.
Napoléon Tremblay,
Joffre Avenue, Hull, Que.
Elzéar Verreault,
191 rue du Pont, Québec.

Villeray Crushed Stone Co.,
2111 de Lanaudière St., Montreal
Villeray Cut Stone, Limited,
845 du Rosaire St., Montreal.
Villeray Quarry Co., Limited,
848 Du Rosaire Street, Montreal.
Hector Vinet,
4614 Notre Dame East, Montreal.
Wright & Company, Ltd.,
Hull, Que.

MARBLE

The British Canadian Marble Co., Ltd.,
St. Joseph de Beauce, Que.
The Pontiac Marble & Lime Co., Limited,
193 Sparks St., Ottawa
Wallace Sandstone Quarries, Ltd.,
Philipsburg, Que.

POTTERY

W. & D. Bell,
1286 St. Valier St., Quebec City.
Canada Firebrick Co., Ltd.,
371 Aqueduc St., Montreal.
Canadian Potteries, Limited,
St. John's, Que.
Citadel Brick & Paving Block, Co., Ltd.,
Quebec City.
La Compagnie de Tuyaux de Drainage Ltée.,
L'Islet Station, Que.
Dominion Sanitary Pottery Co., Ltd.,
St. Johns, Que.
G. H. Farrar,
Iberville, Que.
David T. Hodgins,
Shawville, Que.
Montreal Terra-Cotta Co., Ltd.,
511 St. Catherine St. West, Montreal.
Standard Clay Products, Limited,
St. John's, Quebec.

SAND

Emile Berard,
Mount Johnson, Que.
Robert Boa,
Lachute, Que.
Bonner Sand & Ballast Co., Ltd.,
South Durham, Que.
William Brault,
16, First Avenue, Sherbrooke.
Aug. Choquette,
Mount Johnson, Que.
La Compagnie Nolin, Enrg.,
Pointe aux Lièvres, Que.
Consolidated Sand Company,
270 Ottawa St., Montreal.

William Fraser,
Dorval, Que.
Euclide Gosselin,
Ascot Corner, Quebec.
Joseph Guertin,
St. Joseph de Sorel, Que.
Lachance Limitée,
99 Dalhousie Street, Quebec City.
Laurentide Sand & Gravel Ltd.,
7 St. James St., Quebec City.
Melançon & Frère,
Grand'Mère, Que.
Standard Sand Co., Ltd.,
St. Félix de Valois, Que.
Napoléon St. Louis,
Fontarabie, Maskinongé Co., Qué.

SANDSTONE

Jos. Blais, Enrg.,
8 Mont Marie Ave., Levis.
James Carrigan,
St. Louis road, Ste. Foye, Que.
Miles Lonergan,
147 Mountain Hill, Que.
Consolidated Sand Co., Ltd.,
270 Ottawa St., Montreal.
Normand & Normand,
St. Romuald, Que.
H. F. Routhly,
Haileybury, Ont.
Silico, Limited,
103 St. François Xavier St., Montreal.
The Sydney Kirby Co., Ltd.,
213 Sussex St., Ottawa.
J. B. & Jos. Vézina,
St. Louis road, Ste. Foye, Que.

SLATE

The British Canadian Marble Company, Ltd.,
St. Joseph de Beauce, Que.
Canada Slate Corporation,
St. Anselme, Dorchester Co., Que.
The Mystic Slate Co., Ltd.,
Mystic, Quebec.
New Rockland Slate Co.,
Room 501, Southam Bldg., 128 Bleury St., Montreal.
Slate Products Co. of Canada Ltd.,
Room 501, Southam Bldg., Montreal.

STATISTICS OF ACCIDENTS

REPORTED FROM THE MINES AND QUARRIES DURING THE YEAR 1922.

(A. O. Dufresne)

It is gratifying to note that a resumption of mining activity took place in 1922 in the Province of Quebec. The year 1921 had been one of stagnation, which followed the after-war period of activity of 1919 and 1920.

The improvement in the market of asbestos, mica, silica; the renewal of interest in the gold deposits of Dubuisson township; the operation of the newly discovered feldspar deposits of Derry township; new outlets for the mineral paints (natural iron oxides); and more particularly the growing development in the stone quarries, all contributed to the employment of a great many more men in the mining industry.

However there was practically no operations of metalliferous mines. All the mines of chromite, titaniferous iron, molybdenite, copper and sulphur ores, and lead and zinc ores were idle all year.

The statistical figures given in the tables following are compiled from the return which the operators of mines and quarries must make, in compliance with the provisions of the mining law. Therefore they reflect the state of the mineral industry during the year, and being from the same source they can be compared with figures from previous years, to show the progress and development of the Quebec mining industry.

The first table shows the number of workmen employed in the production of each of the mineral products. The second gives information on the average wages earned by the miners and mine labourers. The other tables give the statistics of the accidents which occurred in the mines, quarries and ore mills.

From Table I it will be observed that during 1922, some 7,808 men found employment, for periods of variable lengths, in the mines and the quarries of the Province of Quebec, as compared with 6,616 for the previous year, or an increase of 18%. These men, however, were not employed for the full year. Reduced to a standard year of 300 days, the days of labour would represent the

employment of 5,885 men. This is an increase of 25% as compared with the year 1921. Of this number, 2,689 worked in mines, whereas the other 3,196 worked in the quarries. The increase of labour employment in the mines was 16%, and in the quarries 30% despite the considerable decrease in the operation of the cement mills.

TABLE I

PERSONS EMPLOYED IN THE MINES, QUARRIES AND ANNEXED PLANTS IN THE PROVINCE OF QUEBEC, DURING 1922

MINES, QUARRIES AND PLANTS	Number of men Employed	Number of men calculated on 300 day basis.	
	1922	1922	1921
Asbestos (quarries and mills)	2,993	2,246	1,920
Copper and pyrite, Silver, Gold	66	56	31
Chrome (mines and mills)	20	2	40
Feldspar, Kaolin (mines and mills)	167	88	66
Graphite, Mica, Phosphate (mines and mills)	182	102	59
Magnesite, Dolomite	169	102	104
Marl	.....	.....	4
Mineral Paints, Ochre (pits and mills)	84	56	35
Mineral water (springs and works)	6	1	3
Molybdenite	7	5	5
Quartz and Silica rock (quarries and mills)	46	22	15
Talc	16	4	.....
Titaniferous iron ore, Zinc and Lead	15	5	33
Brick, Pottery, (clay pits and plants)	967	650	370
Cement (quarries and plants)	570	523	783
Granite (quarries and works)	523	345	188
Lime (quarries and kilns)	252	254	131
Limestone (quarries and dressing works)	1,342	1,164	799
Marble, Slate, Sandstone (quarries and works)	194	137	122
Sand (pit and river sand)	189	123	65
	7,808	5,885	4,773

Of the 7,808 men which found employment in the mineral industry 3,771 worked in mines, and this figures includes 224 men who worked in mines which did not ship during the year. This, however, does not include the assessment work exacted by the

mining law to be performed yearly on mining claims or mining licenses.

Such development work without shipments of ore, was performed on the asbestos deposit of the Queen Asbestos Co., Cleveland township; on the copper deposit of the Quebec-Megantic Copper Co. Ltd., in Inverness township; on the feldspar deposit of the St-Lawrence Feldspar Co. at Manicouagan; on the graphite deposit of the Standard Graphite Co. Ltd., in Boyer township; on the claims of the Molybdenite Reduction Co. Ltd. of Lacerne township; on the iron oxide deposit of the Montmorency Paint Products Co., at Ste-Anne de Beaupré; on the gold claims of the Kienawisik Gold Mining Co. of Portland, Maine, of the Stabell Gold Mines Ltd., of the Union Mining Corporation in Dubuisson township, and of the Lake Fortune Mining Co. Ltd., in Boischatel township, and at the mine of the Federal Zinc and Lead Co., in Lemieux township, Gaspé county.

It will be seen, by the Table of Mineral Production given on page 8 of this report, that the total wages paid during the year amounts to $5,714,432 which is a decrease of 19% as compared with the previous year's figures of $6,300,204. In the year 1922 the sum was divided as follows: $2,682,541 were paid to men employed in the mines and $3,031,891 to men employed in the quarries as compared with $3,444,336 and $2,855,863 respectively for the previous year.

The decrease in the total paid to men employed in the Quebec mineral industry is mainly due to the decrease in the rate of wages paid by the operators of asbestos mines. The average yearly wages for a 300-day year in the mines and quarries during the year 1922 was $971 as compared with $1,320 for 1921. The asbestos labourers' wages were reduced from 42½ cents an hour in 1921 to 25 cents. Corresponding reductions prevailed for unskilled labour in the quarries. The reductions for skilled labour were less proportionately.

It is gratifying to report that there were no labour troubles in the Quebec mines in 1922. Unfortunately asbestos mines operations were so reduced during the first part of the year that measures of relief had to be resorted to so as to alleviate the distress. During the winter months as much dead work as possible was done, such as cleaning up, repairs, removal of overburden near the edge of pits,

so that the companies managed to keep a great number at work, but at reduced rates of wages to tide over this critical period.

TABLE II

	Number of workmen	Wages	Number of day's work	Number of 300-day workers
Producing mines.....	3,547	$2,587,450	777,891	2,593
Non-producing mines..	224	95,091	28,869	96
Totals.....	3,771	2,682,541	806,760	2,689

TABLE III

Workmen	Number 300 day workers	Accidents		Total	per 1,000 300 day workers
		Fatal	Non-fatal		
Mines.....	2,689	11	213	224	82.9
Quarries.....	3,196	5	43	48	15.0
Totals.....	5,885	16	256	272	46.0

The tables and explanatory notes constituting the subject of this report are based on the two lists accompanying it. The first gives a summary of the series of fatal accidents; the second comprises those that did not result in loss of life, but were so severe that the victim could not go back to work for a period of ten days or more. These are the accidents which the Bureau of Mines considers serious and which the operators of mines and quarries are obliged to report within the shortest delay possible under pain of the penalties provided by law.

Article 2213*a*, of the Mining Law reads as follows: "If while a mine or quarry is being worked, an accident takes place resulting

in loss of life or serious injury, the person working the same or his representative at such mine or quarry, shall forthwith send a written notice to the Minister, specifying the nature of the accident, the number of persons killed or injured and their names if they are known.

Every person not complying with the requirement of this article, shall be liable to the penalties provided in article 2307."

As shown in Table III, in 1922 reports of 272 accidents in mines and quarries were made to the Bureau of Mines, of which 16 were fatal. The previous year 213 accidents had been reported, of which 12 had proved fatal. Table I shows that the number of workmen employed in 1922 in the mines and quarries of the Province was considerably higher than during the previous year. Reduced to a common basis of 1,000 men-year, the proportion of accidents in 1922 was 46 per thousand as compared with 44.6 in 1921.

The 16 fatal accidents recorded in 1922 give a proportion of 2.72 per 1,000 men-year. This figure was 4.5, 1.67, 3.36, and 2.51 respectively for 1918, 1919, 1920, 1921. In the mines the rate was 4.09 of fatalities, and in the quarries, where the risks of accidents are appreciably less it was 1.56. These rates class the mining and the quarrying industries in the hazardous ones. This should incite operators to exercise the utmost caution as regards safety methods. No dangerous practices should be tolerated and the strictest attention should be paid to enforce all safety regulations made.

The tables which accompany this report are compiled for the information of operators and foremen. They will find in them details as regards causes of accidents and also suggestions of methods of prevention. But operators are reminded that the value of such tables depends in their completion, and in as much as they strictly conform to the mining law in sending without delay to the Bureau of Mines, returns of accidents which result in the laying off of the victim for a period of ten days or more, with as many particulars as possible of the accidents.

All operators of mines and quarries should keep a detailed record of all accidents, even of the minor ones, as well as of the duration of the laying off period resulting. This record should serve as the basis of regulations for workmen, to ensure the greatest safety. The information thus obtained will also serve in a cam-

paign of education to the workmen. Such compilations are necessary for all "Safety first" movements.

In the last fifteen years much has been done, both in the United States and in Canada, to insure the greatest possible protection of

TABLE IV

ACCIDENTS IN MINES, QUARRIES AND ANNEXED PLANTS IN THE PROVINCE OF QUEBEC, DURING 1922

	Fatal		Non-fatal		Totals	
	No.	%	No.	%	No.	%
MINES:						
Underground	—	—	10	3.7	10	3.7
Open pits	10	3.7	119	43.7	129	47.4
Surface	1	0.4	34	12.5	35	12.9
	11	4.1	163	59.9	174	64.0
QUARRIES:						
In pits	4	1.4	29	10.6	33	12.0
Surface	1	0.4	8	3.0	9	3.4
	5	1.8	37	13.6	42	15.4
ANNEXED PLANTS						
Concentrators	—	—	42	15.4	42	15.4
Shops	—	—	12	4.4	12	4.4
Power plants	—	—	1	0.8	2	0.8
	—	—	56	20.6	56	20.6
	16	5.9	256	94.1	272	100%

life and limbs in industrial concerns. The devotion and earnestness of officials, the co-operation and the education of the workmen, the generous contributions of boards of directors have all contributed, in many cases, to reduce by one half the frequency and the importance of industrial accidents. It is a splendid achievement, both from the humanitarian and economic standpoints. It reduces the item of indemnity to victims; lowers the rates of insurance, conserves lives and human capacities, and contributes to the happiness both of individuals and of the community.

Among the Quebec mining companies who have undertaken to educate the workmen in that line special mention may be made of the Canadian-Johns-Manville and the Canada Cement Co. The latter is noted for the policy they follow to constantly bring in

improvements in its working methods, and initiated towards the end of 1921, a "Safety First" campaign, which has continued and grown ever since. The officials have sought the solution of prevention of accidents by enlisting the sympathy and the enthusiasm of the workmen. By special and striking methods they keep before the men the causes of accidents; by competitions and rewards they stimulate the earnest co-operation of the men. After a campaign of one and a half year, during which the earnestness of the workmen rivalled that of the officials and foremen, this company can show in the frequency factor of accidents a reduction from 11.1 to 2.8. This should be a glowing example to others operators.

Table IV is a classification of accidents in mines and quarries according as they occurred on the surface, underground, in mills, workshops or power houses. It gives the number of accidents, fatal and non-fatal, in each group, and its proportion to the total. By comparison with this table for 1921 it will be observed that there were more fatal accidents in mines, and fewer in the quarries; whereas for non-fatal accidents the case is reversed.

In these statistical figures accidents do not enter which occur in the operation of lime kilns, in cement factories after the stage of crushing of the raw materials, or in the operation of the kilns in which brick is burned. These enter in the class of accidents in manufacturing industries.

TABLE V

ANALYSIS OF FATAL ACCIDENTS IN MINES, QUARRIES, ANNEXED PLANTS IN THE PROVINCE OF QUEBEC FOR 1922

	Underground	Open pits	Surface	Total	
				No.	%
MINES:					
Falls of rock	—	8	—	8	72.7
Cable-derricks	—	1	—	1	9.1
Explosives	—	1	—	1	9.1
Electricity	—	—	1	1	9.1
	—	10	1	11	100%
QUARRIES:					
Falls of rock	—	4	1	5	100%
	1	4	1	5	100%

TABLE VI

ANALYSIS OF NON-FATAL ACCIDENTS IN MINES, QUARRIES, AND ANNEXED PLANTS IN THE PROVINCE OF QUEBEC, DURING 1922

	Under-ground	Open pits	Surface	Total No.	Total %
MINES:					
Falls and slides of rock	4	43	2	49	30.0
Railroads	2	15	12	29	17.8
Cable-derricks	—	18	—	18	11.0
Locomotive cranes	—	18	—	18	11.0
Falls	1	6	8	15	9.2
Miscellaneous	1	3	4	8	4.9
Explosives	1	1	2	4	2.5
Falls of Object	1	1	2	4	2.5
Steam shovels	—	4	—	4	2.5
Hammering rock	—	3	1	4	2.4
Drilling	—	3	—	3	1.8
Machinery	—	2	—	2	1.2
Nail	—	1	—	1	0.7
Infection	—	1	—	1	0.7
Electricity	—	—	1	1	0.6
Carbide	—	—	1	1	0.6
Aerial Tramway	—	—	1	1	0.6
	10	119	34	163	100%
QUARRIES:					
Railroads	—	7	2	9	24.4
Falls of rock	—	7	—	7	18.9
Explosives	—	5	—	5	13.5
Derricks	—	4	—	4	10.8
Falls	—	1	2	3	8.1
Tools	—	1	1	2	5.4
Hammering rock	—	2	—	2	5.4
Winch	—	—	1	1	2.7
Steamshovels	—	1	—	1	2.7
Fall of objects	—	—	1	1	2.7
Drilling	—	1	—	1	2.7
Electricity	—	—	1	1	2.7
	—	29	8	37	100%

	Concen-trators	Repair Shops	Power Plants	Total No.	Total %
ANNEXED PLANTS:					
Machinery	8	3	—	11	19.7
Gearing and Shafting	11	—	—	11	19.6
Falls	9	2	—	11	19.6
Falls of object	4	2	1	7	12.5
Bagging	3	—	—	3	5.3
Miscellaneous	1	2	—	3	5.3
Falls of rock	2	—	—	2	3.6
Burns	1	—	1	2	3.6
Infections	1	1	—	2	3.6
Cobbing	2	—	—	2	3.6
Tools	—	2	—	2	3.6
	42	12	2	56	100%

Tables V and VI give the detail of the causes of fatal and non-fatal accidents. They will be useful to operators who take an interest in the prevention of accidents. They show the most frequent causes of accidents and will permit to take steps towards eliminating them. The very special attention of foremen, shift bosses, and workmen is particularly called to the number and gravity of wounds caused by falls of rock. This year out of 16 fatal accidents 13 are ascribable to the fall of loose rock accidentally detached from the side of open pits or faces of open workings.

There are some mineral deposits, possessing parallel walls, and dipping more or less steeply, which are worked by open-cast methods. As the excavation deepens, comes a time when one of the walls overhangs the working face and the bottom of the pit. Such conditions prevail particularly in the asbestos deposits east of Thetford Mines. In this part of the townships of Thetford and Broughton, the asbestos bearing serpentine forms a band varying between one hundred and three hundred feet wide, which cuts the country rock with a dip varying between 45° and 90°. When the excavation attains a certain depth, it is of course necessary to work under the hanging wall to mine the serpentine.

At both Robertson and East Broughton the painful experience of the last few years, has shown the dangers of such mining methods. The hanging wall is constituted by bedded quartz rock which is cut by numerous fracture planes. In many places these fissure planes show rust and weathering, and lack cohesion; they are frequently wide enough to allow free infiltration of surface water. If the asbestos bearing serpentine is withdrawn from the hanging wall there is danger of rock slides. This is what happened as will be seen further in the description of accidents, in the pit of the Asbestos Mines Ltd., at East-Broughton where a large overhanging ledge of rock fell to the bottom of the pit, killing four men, injuring a fifth, and completely burying the steam shovel near the face.

Therefore, in working such deposits, the serpentine under the hanging wall should not be withdrawn, or if it must be mined, then the overhanging country work must be brought down, and have a straight face, without any overhanging ledges.

TABLE VII

ACCIDENTS BY ROCK FALLS AND SLIDES, BY MONTH, DURING 1922.

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
NON-FATAL													
Underground	..	..	..	..	..	..	..	..	3	..	..	1	4
Open Pits	1	..	5	4	2	5	3	6	9	5	2	3	45
Quarries	..	..	1	..	1	2	..	1	..	..	2	..	7
FATAL													
Underground	..	..	..	..	..	..	..	..	..	..	..	..	..
Open Pits	2	..	..	..	..	..	..	..	..	2	4	..	8
Quarries	..	..	..	..	..	1	..	..	..	1	1	2	5
	3	0	6	4	3	8	3	7	12	8	9	6	69

In sand pits, owing to the ease with which the working face can be undermined, more especially in winter, there is a tendency to withdraw the sand or gravel, from the floor and form rooms of which the roof is only three or four feet of frozen soil. This method is dangerous in the extreme. Sooner or later the roof comes down; and too often, unfortunate labourers are caught in the fall. This practice of undermining in sand or clay pits should be absolutely forbidden. Foremen should always see to it that all frozen overburden, either overhanging, or bordering the edge of open pits, is removed before undertaking work of any kind in the vicinity.

In our previous annual reports numerous notes will be found regarding recommendations and suggesting precautions to take in the handling of explosives; drilling blast holes; haulage of ore by mine cars; in the operation of cranes and steam shovels, and of the numerous cable derricks used in the asbestos mines. All these are causes of accidents, which can be greatly reduced by the application of elementary safety rules. Operators interested in Safety first movements will find in these reports useful recommendations and suggestions.

FATAL ACCIDENTS DURING THE YEAR 1922 IN MINES, QUARRIES AND ANNEXED BUILDINGS IN THE PROVINCE OF QUEBEC

No	Date	Name of Operator	Name of Injured	Age	Occupation	Nature of Wound and Cause of Accident
1	Jan. 20	Black Lake Asbestos & Chrome Co., Ltd.	Alex. Hamel	27	Driller	Crushed to death in pit No. 6. When helping to place dynamite in a seam in the rock large pieces of rock fell, burying this man and his companion.
2	Jan. 20	Black Lake Asbestos & Chrome Co.	Isidore Levesque	40	Driller	Companion to Hamel.
3	Feb 3	Bennett-Martin Asbestos & Chrome Mines Ltd,—Vimy Ridge mine	Willie McCraw	22	Box loader	Buried under rock from premature blast, while loading a crane-box.
4	Apr 10	The Canada Paint Co. Ltd., Red Mill Oxide mines.	François Roy	32	Millman	Was electrocuted at power line terminal.
5	June 24	Canadian National Railways, Van Bruyssel sand pit.	Joseph Gauthier	63	Labourer	Buried under land slip while at work in sand pit.
6	Oct. 5	Bennett-Martin Asbestos & Chrome Mines Ltd, Vimy Ridge mine.	Ovide Cyr	32	Labourer	Instantly killed when struck by big piece of frozen earth and rocks which fell down from the side.
7	Oct. 10	Jos. D. Naud's quarry	Arhurn Young	34	Quarryman	While moving large stone in the quarry yard it fell on him pining to the ground. He died from wounds inflicted.
8	Oct. 23	Bell Asbestos Mines	Alphonse Turcotte	37	Cobber	Deceased was cobbing crude in open cast pit when a few men were barring down loose stones from the jam. While so doing a large rock rolled down and hit the cobber on his left thigh, causing rupture of femoral artery. Loss of blood caused death.
9	Oct. 21	Asbestos Mines Limited	Jos. Boucher	13	Labourer	Buried and killed under a fall of rock when working steam shovel under overhanging rock in open cast pit.
10	Oct. 24	Asbestos Mines Limited	Odilon Grosleau	20	Labourer	Ditto.
11	Oct. 24	Asbestos Mines Limited	Wilfrid Mathieu	26	Labourer	Ditto.
12	Oct. 24	Asbestos Mines Limited	Edmond Breton	25	Labourer	Ditto.
13	Nov. 29	Read' sand pit	Sdrien Dionne	35	Foreman	Died of wounds by fall of stump from edge of sand pit.
14	Dec. 12	Maple Leaf Asbestos Corporation, Ltd.	Wilbrod Flageol	21	Box loader	Died from compound fractures of left leg and loss of blood, when struck by rock rolling from jam.
15	Dec. 14	Eddy Brosseau's sand pit	Lucien Leblanc	22	Carter	Killed by fall of frozen ground while under caving in gravel pit.
16	Dec. 14	Eddy Brosseau's sand pit	S. Renault	17	Carter	Ditto.

Description of Fatal Accidents

On January 21st Isidore Levesque, aged 40, and Alex. Hamel, 27, were killed by a fall of rock at 2.20 P.M. in Pit No. 6 of the Black Lake Asbestos and Chrome Co. Ltd.

The mine is worked in benches, 25 feet high. At the place of the accident, at the foot of the second bench, could be seen after the accident numerous parallel fissures, going into the face.

The practice here is to bring down the rock by drilling a row of horizontal holes, 16 feet deep, at the base of the bench. After blasting the driller and his helper make an examination of the place and scale all loose rock. The large blocks are block-holed and the rock is loaded in the cable-derrick boxes. At the end of December, a row of horizontal holes had been fired, but had resulted in blow-outs, and had caused a wide fissure 16 feet long at the base of the face. Owing to the dip of the fracture planes it frequently happens that large slices of rock overhang the floor after the blasting.

During the morning on the day of the accident, Levesque and his helper placed three bunches of cartridges, 40 in all, to bring down a part of the face, and fired them.

This blasting did not have the required result. After having examined the place it was decided to put another charge, double the size of the previous one, in the chamber caused by the explosion. Just as one of the men was placing the first cartridge the rock fell. Two large blocks knocked down the two men. The larger of the two blocks, weighing probably 12 to 13 tons, crushed Levesque, and the second, 1½ tons knocked down Hamel. The two men were dead when help came.

The post-mortem examination showed in the case of Levesque, a fracture of the skull above the left eye, a crushing of the chest; fracture of the right arm, both legs, and of other wounds. In the case of Hamel there was a large contusion in the region of the abdomen; crushing of the pelvis; and other wounds.

Verdict: accidental death.

On February 3rd, at Vimy Ridge mine operated by the Bennett-Martin Asbestos and Chrome Mines, Ltd., Willie McCraw, aged 22, was killed by a premature blast. The accident occurred at 11.45 A.M. McCraw was loading a box at the foot of the talus of blasted rock, at the west end of the quarry. The firing gang had

loaded 100 cartridges, in five holes drilled horizontally at the base of the face. At the time of the accident, the gang was connecting the wires for the firing when, by error, the foreman of the gang connected the blasting wire with a lighting current wire, which prematurely exploded the round of holes, just opposite the place where McCraw was working. The victim was buried under the rock slide, and it took five hours of arduous work to get at the body.

At Vimy Ridge mine, the electric wires are strung on a row of posts 12 feet high, along the top of the working face. On these posts run four insulated wires, two of them strung near the top of the posts form the lighting circuit; the other two, four feet from the ground are used exclusively for blasting. For the need of the moment the lighting circuit had been extended to the base of the spur on the west side of the quarry. As the space between the two points was considerable the sag brought the lighting wires within two or three feet above the ground.

In the blasting circuit there is a switch, placed in a small shed, fifty feet from the edge of the working face. The ends of the last wires of this circuit are on the last post on the west side of the quarry. It is here that the wires should be connected after a test with the galvanometer, for the blasting circuit.

The charging of the holes, and the connection of the first pair of wires had proceeded without incidents until the boss of the blasting gang made the last connection with the permanent blasting line. He sent previously one of his men to the switch shed to make sure that the circuit was open.

Mistaking the extended temporary wires of the lighting circuit for those of the blasting circuit he connected them, and the explosion took place.

The jury at the coroner's inquest rendered a verdict of accidental death recommending that the company make a rule to connect the blasting wires with the permanent part of the line only at the time of the blasting.

On April 10th, Francis Roy, aged 32, working in the grinding mill of the Canada Paint Co. Ltd. at Red Mill, was electrocuted. The accident took place at the transformer sub-station for the spur line transmitting power to the mill. It had been raining during the night, and Roy took hold of a wet ladder which was resting against the transformer tower. In lifting the ladder the top touched a wire carrying 10,000 volts. Death was instantaneous.

On June 26th, Joseph Gauthier, aged 63, employed in a ballast pit of the Canadian National Railways, at Van Bruyssels on the Lake St-John line was buried under a sand slide.

This man was working on a gang loading ballast for the railway, when the upper part of the face of the sand pit, which had been undermined by the men and was overhanging, fell on the victim who was smothered to death before he could be rescued.

On October 5th, Ovide Cyr, aged 32, miner, working at the Vimy Ridge mine was killed by a rock slide which occurred at 10.40 P.M.

Cyr, with other men, was working near a steam shovel, which was stripping off the overburden at the east end of the working face. In places this overburden is 20 feet thick.

As the steam shovel arm is short, there was left at the top of the face an overhanging strip of earth some two feet wide. At the time of the accident, the steam shovel after discharging a bucketful was returning to the face for another filling when the chain which controls the arm broke. The bucket fell on the ground. Cyr and another man came forward to look at the bucket and to determine the nature of the necessary repair. Just as they were coming away a large piece of gravelly earth loosened from the overhanging ledge and Cyr was completely buried under it. When picked up he was lifeless. The fracture of the spine in the region of the neck had caused instantaneous death.

This accident shows that the principal parts of a steam shovel should be subjected to careful periodical examinations, and that men should never stand under an overhanging ledge of earth or of rock even for a few instants.

Verdict: accidental death.

On October 14th, Arthur Young, employed as a labourer in the quarry operated by Joseph D. Naud, at St-Marc-des-Carrières, was fatally injured by the sliding of a block of rock. He died on the 24th at St-François d'Assise Hospital in Quebec.

On the morning of the accident, Young and his employer Mr. Naud were shifting some blocks of stone which were piled up on the surface, near the quarry.

These blocks owing to their weight were being moved with a crane. The two men set the hook of the grip, the crane man tightened the rope, and the two men turned to withdraw from the

spot. The tightening of the rope displaced the hooked block and this disloged another block, wieghing 1,500 lb. which slid down in the direction of the receding men and struck Young who had been delayed in his get away, owing to his having stumbled. There were no bones broken, but painful flesh wounds on both legs. The victim was taken to the hospital, but amputation of one leg was deemed necessary, from which the victim died one week after the operation.

On October 23rd.—Alphonse Turcotte, aged 37, was killed at the Bell mine by a fall of rock.

The victim was cobbing crude asbestos at the foot of a jam of blasted rock in the bottom of the open-cast pit. During the afternoon the foreman had given orders to bar down some loose rock 60 to 80 feet up the jam. He called the cobbers and the box loaders away from the foot of the jam and ordered to remove all the cable derrick boxes. Turcotte went on working near a box some distance from the foot of the jam. The men scalling the wall brought down a large block of rock weighing from 500 to 600 pounds. It came down the talus with accelerated speed. The victim saw it loosened, saw it coming towards him, and started to run away with his head turned watching the rock rolling down. He stumbled against a cable derrick box and the rock pinned him against the side of the box. When picked up it was found that he had a deep wound but no more than one inch in length at the root of the thigh. He died a few minutes later of a hemorrhage by the severing of the femoral artery.

Verdict of accidental death.

On October 24th 1922, Joseph Boucher, 42 years of age, Wilfrid Mathieu, 25, Odilon Grosleau, 21, Edouard Breton, 35, were killed and Philippe Doyon, 29, was injured by a rock slide in the open pit operated by Asbestos Mines, Ltd., at East Broughton. After an examination of the place of the accident, the deposition of the witnesses at the coroner's inquest and other information, the particulars of the accidents are as follows:

The asbestos deposit worked by this company is situated at the western end of lot 13, range IV of Broughton township. The deposit is in the form of a sheet of a maximum thickness of 100 feet, dipping towards the south 40 to 50°. The country rock is silicious schists with a dip parallel to the dip of the sheet of

serpentine. The rock is seamed by fissures at right angles to the bedding planes. The workings are in benches. The easternmost one is 45 feet deep, the second one is 20 feet deeper. The ore is hoisted by an incline from the floor of the pit to the storage bins. As the working face advances towards the east the incline is lengthened and the pit deepens. The bottom of floor of the pit is about 15 feet in width. The sides of the pit are given a slope of 60°. Owing to the narrowness of the serpentine sheet, the foot wall is encountered at a depth of about 40 feet, and as the pit deepens, the schists overhang more and more.

On the 19th, five days before the accident, the manager ordered the overhanging part to be trimmed off, and Boucher one of the victims, drilled that same day five long holes for the purpose of blasting it off. As there were still some 150 tons of ore to be removed from the floor of the pit it was decided to hoist this before blasting the overhang, so as not to mix the two. This work was finished on the following day. But mining was proceeded with until the day of the accident. At the working face, just under the hanging wall, was a block of serpentine which was not in line with the working face. Boucher decided to blast it down, which was done on the day before the accident.

The removal of this spur or pillar of serpentine lengthened the ledge of overhanging schists, as far as a plane of fracture along the working face. This ledge was weakened by the removal of the serpentine pillar. It was decided to blast it down at the end of that day. At noon two men, Roy and Dodier went around the edge of the pit, above the overhanging part and did not observe any fissuring of any kind.

After the dinner hour one of the men observed that an occasional fragment fell from the hanging wall of the quarry. He pointed this out to the other men, but all went on working, when seven or eight minutes later, between 12.30 and 12.45, a part of the overhanging ledge fell, burying the steam shovel and six men, of whom only two escaped death.

The part of the ledge which fell down was one hundred feet wide. The east end of the ledge abutted against the fracture plane in line with the face of the lower bench. The slide consisted of some 1,700 tons of rock.

A few hours after the accident, Boucher's body was uncovered.

The post-mortem revealed that death was caused by compression of the chest and pelvis, with compound fracture of the legs.

In order to ensure the safety of the men who were working night and day to get at the bodies of the victims, a large quantity of rock had to be brought down which made so much more material to remove, before reaching the bodies of the victims.

On November 29th, Adrien Dionne, aged 35, foreman, was killed in a sand pit at Ulverton.

Dionne was overseer for the Roads Department, at the sand pit. As in many other pits, undermining at the face was resorted to. The fall of the overhanging edge was the cause of the accident. A large log which was on the surface rolled down to the floor of the pit and struck the victim. He died a few days later from complications resulting from two broken ribs and a broken leg.

On December 12th, Wilbrod Flageol, aged 21, box-loader at the Maple Leaf mine was killed by a slide from a rock pile.

Flageol was chaining some large pieces of rock from the talus, when a slide of the pile occurred which knocked him down. He was picked up with a broken leg, and he died a few days later from the complications of this injury.

On December 14th, Lucien Leblanc, aged 22, and S. Renault, aged 17, both teamsters for Messrs. Lizote and Dansereau, road contractors, at Abbotsfort, were killed by land slide in Mr. Eddy Brosseau's sand pit.

These men were loading their carts, on the floor of the sand pit at a place where frozen earth was overhanging in a ledge of five and half feet deep, and one and a half feet thick. The foreman had just drawn their attention to the danger and ordered them to withdraw from the place, when the fall occurred, burying the two teamsters.

Lucien Leblanc died from a fracture of the skull and of a broken neck. Renault died from internal injuries and fracture of the leg.

NON-FATAL ACCIDENTS DURING THE YEAR 1922

IN MINES, QUARRIES AND ANNEXED BUILDINGS IN THE PROVINCE OF QUEBEC

No.	Date	Name of Operator	Occupation	Age	Nature of Wound and Cause of Accident
1	Jan. 3	Canadian Johns-Manville Co., Ltd..	Machinist.....	....	Deep laceration of palm of left hand in attempting to screw grease cup down on crowding engine while running in repair shop.
2	Jan. 3	The Citadel Brick & Paving Block Co., Ltd.	Labourer.....	24	Ankle sprained foot caught under car at transfer plate in yard.
3	Jan. 5	The Citadel Brick & Paving Block Co., Ltd.	Labourer.....	59	Thumb and finger injured when struck by derailed car in quarry.
4	Jan. 9	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Labourer.....	....	Left side bruised when struck by sleigh box in yard.
5	Jan. 9	Canadian Johns-Manville Co., Ltd..	Miner.....	31	While at work on track in open cast pit was struck on wrist by a piece of board.
6	Jan. 16	Canadian Johns-Manville Co., Ltd..	Fireman.....	29	Bruised chest and right knee sprained. Fell downstairs in locomotive house, blind by smoke.
7	Jan. 16	Canadian Johns-Manville Co., Ltd .	Brakeman.....	31	Laceration of third degit right hand. Finger caught between coupler and car when draw bar receded as he was holding pine of coupler.
8	Jan. 17	Canadian Johns-Manville Co., Ltd..	Miner.....	32	Sprained chest while at work in open cast pit.
9	Jan. 19	Canadian Johns-Manville Co., Ltd..	Brakeman.....	25	Struck on left knee by switch handle of open cast pit railroad.
10	Jan. 21	Asbestos Corporation of Canada, Ltd., British Canadian mine.	Labourer.....	....	Sprained neck. Fell with a bag on shoulder, at work in yard.
11	Jan. 22	Canadian Johns-Manville Co., Ltd..	Machinist.....	50	Inflammation of knee. Struck knee with sledge in shop.
12	Jan. 23	Canadian Johns-Manville Co., Ltd..	Miner.....	35	Sprain of left knee, sitting on leg while cobbing in open cast pit, felt knee sore.
13	Jan. 23	Canadian Johns-Manville Co., Ltd..	Miner.....	45	Ulcer on left eye, caused by flying piece of ice. Not reported at first.
14	Jan. 23	Canadian Johns-Manville Co., Ltd..	Millhand.....	51	Infection to finger, struck finger working on cyclone in mill.
15	Jan. 24	Canadian Johns-Manville Co., Ltd..	Miner.....	26	Contusion of left leg. Rock fell on leg while unloading rock from steam shovel dipper.
16	Jan. 24	Bennett-Martin Asbestos & Chrome Mines Ltd., Vimy Ridge mine.	Box loader.....	21	While loading boxes, a sharp stone left the side of the pit and struck him on the middle finger right hand, making a deep cut.
17	Jan. 25	Asbestos Mines, Limited.....	Carter.....	....	Driving a team he fell on his sleigh, bruising left side.
18	Jan. 25	Consolidated Asbestos, Limited....	Miner.....	....	While removing battery from case with lever same slipped striking him below left eye.
19	Jan. 26	Bell Asbestos Mines.....	Labourer.....	..21	Carrying deals on his shoulder, he slipped on ice and fell, the deals struck. his left foot spraining ankle.
20	Jan. 31	Bennett-Martin Asbestos & Chrome Mines, Ltd.,	Box loader.....	39	While loading boxes a heavy rock left side of pit and struck his right leg crushing it badly.
21	Jan. 31	Asbestos Corporation of Canada, Ltd British-Canadian mine.	Miner.....	....	Back sprained. Was struck by a crow bar he was handling when a stone fell on same.
22	Jan. 31	Consolidated Asbestos, Limited....	Millhand.....	....	Left leg bruised. In trying to pull a bar out of a bolt hole, same suddenly slipped causing the injured to step in a belt hole.

NON-FATAL ACCIDENTS 1922

No.	Date	Name of Operator	Occupation	Age	Nature of Wound and Cause of Accident
23	Feb. 1	Asbestos Corporation of Canada, Ltd, King mine.	Labourer		Cut of scalp, struck by electric trolley.
24	Feb. 3	Asbestos Corporation of Canada, Ltd, British Canadian mine.			In open cast pit rock rolled from jam and struck him, bruising right wrist
25	Feb 5	Canadian Johns-Manville Co., Ltd	Miner	22	Foot caught between rock and running board of locomotive.
26	Feb 9	Bell Asbestos Mines	Teamster	56	Contusion of the left leg. Tie rolled down from pile near sawmill.
27	Feb 9	Asbestos Corporation of Canada, Ltd., King mine.	Miner		Stone struck him on foot.
28	Feb 9	Bell Asbestos Mines	Trackman	43	Working track on dump. In lifting a tie with a pick it dropped on his right foot.
29	Feb 10	Asbestos Corporation of Canada, Ltd, Beaver mine.	Miner		Cut on head. Stone fell on his head.
30	Feb 13	Consolidated Asbestos, Ltd	Millhand		While conveying dirt with a wheelbarrow he slipped and injured his right knee.
31	Feb. 15	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Box loader	32	Rock fell on his right hand, bruising it.
32	Feb. 22	Asbestos Corporation of Canada, Ltd, King mine.	Labourer		Pain at right side. Struck by stone rolling from jam in open cast pit.
33	Feb 24	Bell Asbestos Mines	Driller	46	Contusion to right wrist. Slipped and fell on a pile of rock.
34	Feb. 27	Consolidated Asbestos, Limited	Millhand		While handling a two-inch deal, it fell on his foot, bruising same.
35	Mar. 4	Consolidated Asbestos, Limited	Miner		Nose broken, when accidently hit in face by fire hose while cleaning out underground pump sump.
36	Mar. 6	Asbestos Corporation of Canada, Limited, King mine	Miner		Finger right hand bruised by stone falling from jam in open cast pit.
37	Mar. 6	Asbestos Corporation of Canada, Limited, British-Canadian mine.	Labourer		Finger left hand bruised by stone falling from jam in open cast pit.
38	Mar. 7	Asbestos Mines, Limited	Labourer	25	While shovelling cement from a box into pails some particles of cement blew into his right eye, causing pain.
39	Mar. 9	Bennett-Martin Asbestos & Chrome Mines, Ltd, Vimy Ridge mine.	Box loader		Calf of right leg bruised, while loading crane-boxes, a rock left side of open cast pit and struck him.
40	Mar. 9	Asbestos Corporation of Canada, Ltd, King mine.	Repairman		Right shoulder and side bruised. Fell from car he was repairing in yard
41	Mar 10	Asbestos Corporation of Canada, Ltd, King Mine.	Box loader		Right leg bruised. Stone rolled from jam.
42	Mar. 13	National Brick Co., of Laprairie, Ltd., Delson plant.	Labourer	45	Stone fell on right foot, big toe bruised.
43	Mar 13	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Box loader	22	Sprained right ankle. Foot caught as box was lowered in place.
44	Mar 14	Asbestos Corporation of Canada, Ltd, King mine.	Millhand		Index finger cut off. Was sweeping with a broom which was caught in running pulley.

45	Mar.	20	Black Lake Asbestos & Chrome Co., Ltd.	Box loader	22	Bruised leg and side. The man was filling ore boxes in pit,—there was a rock weighing about one ton that became loose by the men barring around it, and the victim, failing to take the necessary care, fell under the rock when it gave.
46	Mar.	23	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Box loader	....	Cut to finger left hand. A sharp stone hit his finger while loading a box.
47	Mar.	23	Asbestos Corporation of Canada, Ltd, King Mine.	Labourer	....	Left eye injured by stone falling from jam.
48	Mar.	24	Quebec Asbestos Corporation	Machinist	50	While working on emery wheel chip fell in eye.
49	Mar.	25	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	....	Right wrist sprained in moving asbestos bags in yard.
50	Mar.	29	Canadian Johns-Manville Co., Ltd.	Miner	29	Abrasion of left ankle by gear stricking him on leg.
51	Mar.	30	Black Lake Asbestos & Chrome Co., Ltd.	Brakeman	....	Thumb cut off. Hand caught between draw-bars in coupling cars.
52	Mar.	31	Canadian Johns-Manville Co., Ltd.	Miner	25	Severe contusions right leg. Putting car on track with rope and pulley block, rope broke striking leg.
53	Apr.	1	Black Lake Asbestos & Chrome Co., Ltd.	Millhand	....	Body bruised and badly shaken up. While putting on a belt, part of his sweater hanging out caught on shaft.
54	Apr.	8	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Craneman	29	Right leg broken. While taking shelter in compressor house during a blast, a piece of rock flew in the door and struck him on leg.
54	Apr.	8	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Craneman	29	Right leg broken. While taking shelter in compressor house during a blast, a piece of rock flew in the door and struck him on leg.
55	Apr.	14	Maple Leaf Asbestos Corporation, Ltd.	Labourer	....	Right hand crushed. Trying to clean sand from tailing belt, his hand slipped and glove caught between the collar and the drum.
56	Apr.	17	Canadian Johns-Manville Co., Ltd.	Repairman	22	Nail torn from finger. Caught finger in replacing old tie.
57	Apr.	18	Consolidated Asbestos, Ltd	Millhand	....	Cut to left hand. While putting a piece of sheet metal into separator same fell on his left hand.
58	Apr.	18	Quebec Asbestos Corporation	Millwright	32	Two fingers bruised. Fingers caught in a split pulley while changing pulleys in mill.
59	Apr.	22	Black Lake Asbestos & Chrome Co., Ltd.	Box loader	24	Finger bruised. Was loosening rock with a bar, when bar slipped.
60	Apr.	22	Asbestos Mines, Limited	Carpenter	23	Forehead bruised and fingers crushed when he fell from scaffold through staircase in mill.
61	Apr.	25	Asbestos Mines, Limited	Labourer	32	Left knee crushed in repairing jumbo when shaft made half a revolution and caught knee.
62	Apr.	29	Montreal Crushed Stone Co., Ltd.	Labourer	....	Finger broken in helping to move a car wheel in machine shop.
63	May	1	Black Lake Asbestos & Chrome Co., Ltd.	Box Loader	40	Left hand badly cut, bruised and burnt, when playing with a detonator. He rubbed the detonator across a rock and it exploded.
64	May	6	Johnsons' Company	Millhand	25	Finger lacerated. Picking up stone to feed crusher, had fingers jammed against another stone.
65	May	8	Asbestos Corporation of Canada, Ltd., King mine.	Miner	....	Body and head bruised. Was barring loose rock when rock on which he was standing slid and he fell about 75 feet along the jam.
66	May	9	Johnsons' Company	Miner	....	Cut on head, scalp wounds. Was taking down loose rock when some above him came down hitting him on the head.
67	May	10	Bell Asbestos Mines	Cobber	24	Rib displaced. While cobbing a box loader threw a stone on the end of a shovel which struck him on right side.
68	May	10	National Brick Co. of Laprairie, Ltd.	Labourer	....	Bruised back of right hand, struck by stray stone in unloading car in yard.

NON-FATAL ACCIDENTS 1922

No	Date	Name of Operator	Occupation	Age	Nature of Wound and Cause of Accident
69	May 12	S. B. Norton's quarry	Quarryman	40	Injury to foot caused by stone tipping while he was placing chain around it.
70	May 12	Deschambault Quarry Corporation	Engineman	25	Lost left eye, piece of steel flew in his eye while repairing stationary engine.
71	May 13	Montreal Crushed Stone Co., Ltd.	Quarryman	....	Left leg fractured in helping turning an overturned car. The wheels slipped and the other men let go the car.
72	May 13	O. Martineau & Fils, Ltée, Rosemont quarry.	Stone cutter	67	Fractured bone and contusions to left side. Fell from scaffold.
73	May 15	Asbestos Mines, Limited	Machinist	....	Finger crushed. In dismantling an old engine an iron pipe fell on his hand.
74	May 15	Canada Carbide Co., Ltd.	Quarryman	19	Broken bone left hand. While prying stone loose with crow-bar, stone slipped and caught his left hand between crow-bar and another stone.
75	May 16	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	....	Fingers bruised. Stone rolled from jam and struck his fingers.
76	May 18	Asbestos Corporation of Canada, Ltd., British-Canadian mine.	Labourer	29	Right leg bruised. Caught between drum and conveyor.
77	May 22	Asbestos Corporation of Canada, Ltd., King mine.	Brakeman	34	Chest bruised. Caught between two dump cars.
78	May 26	Bell Asbestos Mines	Miner	46	Right eye injured. Breaking stone in open cast pit a small piece flew to his eye.
79	May 27	Black Lake Asbestos & Chrome Co., Ltd.	Millwright	53	Face and eye lids burned. Was babbiting crusher when some babbit when into his face.
80	June 1	J. A. Larose's Quarry	Labourer	21	Big toe crushed between stones he was rolling into crusher.
81	June 2	O. Martineau & Fils, Ltée., Papineau quarry.	Electrician	25	Hand burned by electric shock in repairing defective wire circuit.
82	June 5	Asbestos Corporation of Canada, Ltd., British-Canadian mine.	Miner	48	Finger bruised, caught between two stones.
83	June 6	Bell Asbestos Mines	Labourer	....	Right foot bruised. Foot caught between rail and carriage wheel in helping to saw lumber in pit.
84	June 7	Consolidated Asbestos Mines	Millhand	....	Broken toe. Dropped a rail on his foot in mill.
85	June 10	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Miner	....	Cut to the nose. While taking shelter a small piece of rock thrown by blast hit him in tunnel underground.
86	June 13	Canadian Johns-Manville Co., Ltd.	Miner	28	Fell off shovel in open cast pit. Cut to left hand.
87	June 13	Consolidated Asbestos, Limited	Millhand	....	Rupture. While bagging asbestos in mill, shovel struck nail in floor.
88	June 13	National Brick Co. of Laprairie, Ltd.	Labourer	....	Bone of nose broken. Struck by winch handle.
89	June 11	Canadian Johns-Manville Co., Ltd.	Labourer	....	Sprain right knee. Tried to jump on running locomotive, pressed step and fool dragged over ties.
90	June 15	Canadian Johns-Manville Co., Ltd.	Miner	33	Contusion and deep abrasion of right knee. Fell in a hole whole moving quickly to get away from blasting stones.
91	June 15	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	26	Left knee bruised by rock rolling from jam in open cast pit.

92	June	15	R. H. Miner Co., Ltd., Deguire quarry.	Labourer	68	Fell while crossing platform coming to work and being of old age arm broke easily.
93	June	16	J. A. Larose, quarry	Labourer	19	In loading a box a stone dropped from his hands on his right foot crushing big toe.
94	June	21	Bennett.Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Crane driver	....	Left wrist injured, while running crane, the lever hit him of left wrist.
95	June	21	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Box loader	42	Big toe crushed by loose rock rolling over his foot while loading crane box in open cast pit.
96	June	21	Asbestos Corporation of Canada, Ltd.	Box loader	23	Right foot bruised, stone fell from side of pit and struck his foot.
97	June	23	Canadian Johns-Manville Co., Ltd..	Driller	....	Two deep scalp wounds and other smaller wounds over body. While drilling rock, same gave away letting him down about 70 feet, and rock partially burying him.
98	June	23	Montreal Crushed Stone Co., Ltd...	Labourer	....	Right hand injured. This man was riding on rear step of locomotive when a lorry loaded with ties and drawn by the locomotive ran against the latter and crushed and bruised his right hand.
99	June	26	J. A. Larose, quarry	Labourer	23	Crushed finger in turning stone over.
100	June	26	Asbestos Corporation of Canada, Ltd., British Canadian mine.	Labourer	55	Hip and left leg injured. Loose stone rolled from jam and struck him.
101	June	27	Asbestos Corporation of Canada, Ltd., British-Canadian mine.	Labourer	28	Toe bruised. Stone struck foot.
102	June	27	O. Martineau & Fils, Ltée, Papineau quarry.	Teamster	20	Broken rib. Cause by mine blast.
103	June	27	Consolidated Asbestos, Ltd		....	While papering a roof, injured party's left knee became swollen and sore.
104	June	27	O. Martineau & Fils, Ltée., Papineau quarry.	Quarryman	30	Broken leg. Struck by stone thrown by mine blast.
105	June	27	Paint River Oxide Co., Reg'd	Carpenter	64	Broken hip. Fell from trestle.
106	June	28	O. Martineau & Fils Ltée, Masson quarry.	Stone cutter	39	Thumb strained when he fell on his thumb.
107	June	28	Black Lake Asbestos & Chrome Co., Ltd.	Box loader	42	A large stone rolled from the top of a pile of rocks, striking the man, knocking him, cutting his right wrist and bruising his right leg.
108	June	28	Bennett-Martin Asbestos & Chrome Co., Ltd., Vimy Ridge mine.	Box loader	....	While loading boxes, had fingers caught between two rocks.
109	July	1	Asbestos Mines, Ltd	Labourer	18	Was loading bucket of rock on aerial rtamway when struck by second bucket, knee crushed.
110	July	1	J. A. Larose, quarry	Foreman	35	Rupture. In turning over a heavy stone which he wanted to block hole.
111	July	4	Bennett-Martin Asbestos & Chrome Co., Ltd., Vimy Ridge mine	Box loader	....	While loading boxes, a big rock left side of open cast pit and struck him on right foot.
112	July	4	Federal Asbestos Company	Labourer	29	Wounded to left leg and left hand when caught between pulley and belt while oiling.
113	July	4	Bennett-Martin Asbestos & Chrome Co., Ltd., Vimy Ridge mine.	Box loader	....	Thumb right hand crushed between rock and crane-box.
114	July	6	Maple Leaf Asbestos Corporation, Ltd.	Fireman	52	Burns on both forearms. Threw some oil on fires to revive them. Explosion followed a sheet of flame bursting through the door severely scorched his arms.
115	July	7	Black Lake Asbestos & Chrome Co.,	Labourer	33	Big toe crushed. A cable derrick box fell on his left foot.

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No.	Date	Name of Operator	Occupation	Age	Nature of Wound and Cause of Accident
116	July 8	Bennett-Martin Asbestos & Chrome Co., Ltd., Vimy Ridge mine.	Brakeman	....	Had left hand fingers caught between two cars. Fingers badly crushed.
117	July 8	Bennett-Martin Asbestos & Chrome Co., Ltd., Vimy Ridge mine.	.....	....	While standing near crane, was caught between crane and car. Head badly bruised.
118	July 11	Bennett-Martin Asbestos & Chrome Co., Ltd., Vimy Ridge mine.	Machinist	....	While at work in machine shop he had left arm pierced by a piece of sheet metal.
119	July 11	Bell Asbestos Mines	Box loader	38	Contusions of left thigh and all over his body. Struck by large rock falling while loading crane derrick box.
120	July 11	Black Lake Asbestos & Chrome Co., Ltd.	Box loader	24	Finger cut. A larger stone rolled down jam and fell on his right hand.
121	July 11	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	31	Left leg injured by stone rolling on it.
122	July 14	Asbestos Mines, Limited	Carpenter	27	While cutting a steel plate with a hammer and cold chisel, the sledge hammer, rebounded and struck his forehead violently.
123	July 15	J. A. Larose, quarry	Labourer	21	Crushed finger in feeding crusher.
124	July 18	Asbestos Corporation of Canada, Ltd., British Canadian mine.	Labourer	48	Stone fell on finger, bruising it.
125	July 18	Bennett-Martin Asbestos & Chrome Co., Ltd., Vimy Ridge mine.	Labourer	....	Right side bruised. While making a ditch near the mill, a millman through a window an old piece of iron which struck this man.
126	July 21	Bathurst Company, Limited	Labourer	26	Fell and struck knee cap on stone.
127	July 27	Black Lake Asbestos & Chrome Co., Ltd.	Driller	27	Was struck on back of head by swinging cable derrick chain. Was knocked down on his face among loose stones. Badly cut on forehead and face
128	July 27	Black Lake Asbestos & Chrome Co., Ltd.	Millwright	34	Fingers cut and bruised. When unblocking a fibre collector his hand was caught in the butterfly.
129	July 31	La Cie. Nolin, Enrg., sablonnière	Engineman	....	Finger amputated. Caught between wire and sheave in sand excavator.
130	Aug. 1	Canadian Johns-Manville Co., Ltd.	Craneman	....	Sprain of muscles, side of chest and of abdomen. High bank of which steamshovel was digging gave away at top, sliding on to side of steam-shovel, smashing board sides in such a manner as to pin the craneman up against the machinery of engine.
131	Aug. 2	O. Martineau & Fils, Ltée, Masson quarry.	Quarryman	18	Struck on head by stone thrown from quarry blast.
132	Aug. 2	La Carrière Bussière, Ltée	Stone cutter	30	Struck on eye by piece of granite which flew from under hammer.
133	Aug. 5	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Fireman	....	Right eye injured. Small cinder flew in his eye while firing engine.
134	Aug. 5	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	....	Right foot bruised, by stone falling from jam.
135	Aug. 8	Asbestos Corporation of Canada, Ltd., King mine.	Carpenter	....	Wound at head. Struck on head by board in mill.
136	Aug. 8	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Repairman	....	Finger injured. Blood poisoning by wood splinter

137	Aug.	8	Canada Carbide Co. Ltd., Stanbridge quarry.	Labourer	40	Finger caught between two stones while loosening them with crow-bar.
138	Aug.	9	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Labourer	....	Left leg badly bruised and cut. Jammed between big rock and crane box.
139	Aug.	10	Canadian Johns-Manville Co., Ltd.	Brakeman	....	Compound commuted fracture of third digit. Was riding on front step of locomotive. Finger crushed in between draw-bar he was holding to when signalling with free hand.
140	Aug.	10	Bennett-Martin Asbestos & Chrome Co., Ltd., Vimy Ridge mine.	Box loader	....	While loading boxes had left foot struck by ore box.
141	Aug.	12	Black Lake Asbestos & Chrome Co., Ltd.		....	Rock fell on left hand bruising it.
142	Aug.	14	D. Guillemette's Asbestos mine	Foreman	70	Broken forearm. While putting one belt on pulley of dryer.
143	Aug.	14	Bennett-Martin Asbestos & Chrome Co., Ltd.	Box loader	....	Back injured. While loading boxes, a loose rock came down and hit him on back.
144	Aug.	14	H. R. Miner & Co. Reg'd, Deguire quarry	Blacksmith	55	Top of small quarry car fell on his shoulder.
145	Aug.	16	Canadian Johns-Manville Co., Ltd.	Trackman	....	Sprain metarsal joint right foot. While riding on push car he jumped as car was approaching cow which had strayed on to track, caught his toe under rail and fell back.
146	Aug.	16	Black Lake Asbestos & Chrome Co., Ltd.	Labourer	....	Rock fell on right hand taking off middle finder at top joint.
147	Aug.	17	Canadian Johns-Manville Co., Ltd.	Labourer	....	While unloading car of coal, he had a wrench on the key which opens hopper gates, the wrench slipped, hitting man, causing contusions of right knee.
148	Aug.	18	Asbestos Corporation of Canada, Ltd., King mine.	Miner	....	Right knee injured by stone rolling from jam.
149	Aug	18	Asbestos Corporation of Canada, Ltd., British-Canadian mine.	Miner	....	Body bruised when carried down jam by loose rock falling in open cast pit.
150	Aug.	19	J. A. Larose's quarry	Labourer	42	Foot crushed by stone dropped on his foot when loading quarry car.
151	Aug.	23	Black Lake Asbestos & Chrome Co., Ltd.	Labourer	....	Rock fell on big toe, bruising it.
152	Aug.	25	Montreal Crushed Stone Co., Ltd.	Quarryman	....	Hands bruised when caught between cables while working around steam-shovel.
153	Aug.	30	The Citadel Brick and Paving Block Co., Ltd.	Labourer	45	Ruptured, when quarry car derailled.
154	Aug.	31	Canadian Johns-Manville Co., Ltd.	Labourer	....	Sprain of right foot. In rolling long timber over uneven ground, nail caught this man's overalls rolling men's foot over timber and then when timber rolled back half way, pinned man's foot under edge of same.
155	Sept.	1	Consolidated Asbestos Ltd.	Shoveler	27	Head and face cut and legs bruised when struck by a fall of rock while digging a hole in a chute for blasting.
156	Sept.	1	Asbestos Corporation of Canada, Ldt., Beaver mine.	Labourer	....	Right knee sprained when struck by stone in open cast pit
157	Sept.	1	Bell Asbestos Mines		....	Contusion of right foot. While standing on steps of locomotive had foot jammed against large rock.
158	Sept.	2	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	....	Cut to left hand on a sharp rock.
159	Sept.	5	Asbestos Corporation of Canada, Ltd., King mine.	Box Loader	....	Finger crushed when rock fell from jam

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No	Date	Name of Operator	Occupation	Age	Nature of Wound and Cause of Accident
160	Sept. 5	O. Martineau & Fils, Ltée, Masson quarry.	Quarryman	43	Wound to eye. Small piece of rock flew from under hammer and struck him on eye when breaking stone.
161	Spet. 6	Consolidated Asbestos Ltd.	Shoveler	20	Left foot bruised while shovelling at glory holes.
162	Sept. 7	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Box loader	....	While loading boxes, a small piece of asbestos went into his right thumb, causing blood poisoning.
163	Sept. 8	Consolidated Asbestos, Ltd.	Oiler	62	Head bruising, whilst cleaning in mill, he struck his head against a pulley in motion.
164	Sept. 9	O. Martineau & Fils, Ltée, Rosemont quarry.	Quarryman	17	Left wrist bruised by explosion of dynamite in quarry.
165	Sept. 9	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	50	Lost left eye. Piece of rock flew in his eye.
166	Sept. 11	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	....	Broken ankle. Struck by stone.
167	Sept 13	Consolidated Asbestos, Limited.	Hoistman	29	Left hand burnt by live wire, in mine yard.
168	Sept. 14	Consolidated Asbestos, Limited.	Shoveler	25	Finger bruised, while shovelling at chute, underground, had right hand caught between rock and crow-bar.
169	Sept. 11	Asbestos Corporation of Canada, Ltd., Beaver mine.	Labourer	....	Head cut and nose bruised when rock fell on his head.
170	Sept. 14	Asbestos Mines, Limited.	Steam shovel	....	Burns on left leg. While cleaning steam shovel, hose became disconnected from the injector.
171	Sept. 15	Bell Asbestos Mines.	Miner	45	Rib displaced. Fell while walking up the jam to bar down loose rock.
172	Sept. 16	National Brick Co. of Laprairie, Laprairie plant.	Quarryman	22	Car loaded with clay passed over toe.
173	Sept. 18	Canadian Johns-Manville Co., Ltd.	Miner	....	Infection of wounds to fingers of both hands. Cut fingers on sharp stone in moving drill derrick.
174	Sept. 18	Asbestos Corporation of Canada, Ltd., Beaver mine.	Cobber	....	Finger bruised. Struck finger with cobbing hammer in cobbing shop.
175	Sept. 18	Asbestos Corporation of Canada, Ltd., Beaver mine.	Miner	....	Left foot injured, by rock falling from jam.
176	Sept. 18	Montreal Quarry, Limited.	Quarryman	30	Struck on head by explosion of delayed blast in quarry.
177	Sept. 19	Pennington Asbestos Co.	Labourer	....	Left hand injured. Hand caught in cable-derrick block and fall rope in open cast pit.
178	Sept. 19	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	....	Left leg bruised. Struck by stone.
179	Sept. 20	Consolidated Asbestos, Ltd.	Shoveler	32	Nose fractured and right leg bruised. Buried under a fall of clay and rock mixed, while loading clay into dump cart.
180	Sept. 20	Canadian Johns-Manville Co., Ltd.	Millhand	....	Sprained back. In trying to lift a bearing box from floor to work bench in mill.
181	Sept. 22	Asbestos Corporaiton of Canada, Ltd., Beave mine.	Miner	....	Stomach ruptured. Was struck by crow-bar when stone fell on it, in open cast pit.

182	Sept.	25	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	....	Finger injured. Punctured finger on sharp stone.
183	Sept.	25	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	27	Right leg bruised. Rock rolled from jam and struck him.
184	Sept.	26	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	35	Right foot sprained. Hurt when two trains collided in yard.
185	Sept.	26	Canadian Johns-Manville Co., Ltd.	Crusher	....	Contusion of left ankle. While breaking rock in slip with a bar, had both feet inside slip, rock slid suddenly pinning left foot to steel lining of slip.
186	Sept.	27	Asbestos Corporation of Canada, Ltd., King mine.	Box loader	32	Right foot injured, rock rolled from jam in open cast pit.
187	Sept.	28	Canadian Johns-Manville Co., Ltd.	Millhand	....	Observing a bearing running hot, he threw a pail of water on same, causing hot oil to fly out of dash pot on to his hand, burning same badly.
188	Oct.	5	Consolidated Asbestos Limited	Shoveler	24	Left side rib broken. Whilst loading cars underground he fell on his left side.
189	Oct.	5	Bennett-Martin Asbestos & Chrome Mines, Ltd., Viny Ridge mine.	Steam shovel	....	While repairing the bucket of the steam shovel a big piece of frozen earth left side of pit and struck the claimant breaking his leg.
190	Oct.	6	Canada Cement Co., Plant No. 3	Quarryman	....	Left shoulder bruised. Was loading stone into a bucket which is conveyed to plant by cable line, when bucket was lowered it swung around pushing this man against the wall.
191	Oct.	9	Consolidated Asbestos, Limited	Millhand	58	Left side of body bruised. Whilst unblocking a spout, he slipped and fell againts a piece of timber.
192	Oct.	9	Bell Asbestos Mines	Box loader	38	Fractured toe and instep bruised. Was loading boxes in open cast pit when big rock rolled from jam.
193	Oct.	10	Maple Leaf Asbestos Corporation, Ltd.	Dumper	33	In lowering a five-ton jack, the jaw accidentally fell, crushing his hand. blood poisoning followed.
194	Oct.	13	Asbestos Corporation of Canada, Ltd., King mine.	Box loader	....	Back sprained in lifting heavy stone in open cast pit.
195	Oct.	14	Asbestos Corporation of Canada, Ltd., King mine.	Box loader	36	Fingers left hand bruised, struck by stone.
196	Oct.	17	Montreal Crushed Stone Co., Ltd.	Quarryman	....	While working in locomotive crane when his hand slipped and was caught in the gears.
197	Oct.	17	Bell Asbestos Mines	Cobber	32	Picking up crude in open cast pit when another man threw a stone on his hand bruising it.
198	Oct.	18	Asbestos Corporation of Canada, Ltd., King mine.	Yardman	....	Wounded at right hand, fell on pump when foot missed step.
199	Oct.	19	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	....	Toe bruised. Piece of frozen earth fell on his foot.
200	Oct.	19	Canadian Johns-Manville Co., Ltd.	Driller	....	Amputation of fingers. Man was drilling block holes near steam shovel On hearing fireman warning man looked up and saw bucket of steam shovel with stone falling from same directly over him. Placing his left hand on a large rock he vaulted over same, but falling stone hit ground and rolled over on the rock on which he had placed his hand, crushing fingers.
201	Oct.	20	Consolidated Asbestos, Limited	Oiler	18	Left knee cut. Whilst unblocking a spout, he slipped and fell against shaft collar.
202	Oct.	24	Asbestos Mines, Ltd.	Steam shovel	29	Right leg broken. Caught by fall of overhanging wall in open cast pit.
203	Oct.	26	Asbestos Corporation of Canada, Ltd., British-Canadian mine.	Labourer	....	Fell on his hands, bruising same.

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No	Date	Name of Operator	Occupation	Age	Nature of Wound and Cause of Accident
201	Oct. 27	Consolidated Asbestos, Ltd	Shoveler	29	Left thigh bruised. Whilst lifting log at chute, it fell on his leg.
205	Oct. 27	Bell Asbestos Mines	Yardman	37	Was carrying dust to dump car with a wheelbarrow he fell off gangway about six feet high and fractured collar bone, small cut on scalp.
206	Oct. 31	Bennett-Martin Asbestos & Chrome Mines, Ltd, Vimy Ridge mine.	Labourer		Deep cut to right hand. While unloading beaters, he fell off car and cut his hand on tooth of an old gear.
207	Oct. 31	Canadian Johns-Manville Co, Ltd.	Labourer		Riding on front foot board of locomotive which was backing under tailing chute, he stepped off to deck trestle, stepped on small stone which rolled throwing him off his balance, he grabbed a large post to hold himself from going under wheels of train, before train could be stopped, side boards of car hit man in back and arm.
208	Nov. 1	Canadian Johns-Manville Co., Ltd	Driller		Fracture of nose, contusion under right eye. Handle a drill wheel flew around and struck him.
209	Nov. 1	Asbestos Corporation of Canada, Ltd, Beaver mine.	Box loader		Left hip sprained when struck by stone.
210	Nov. 7	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Engine driver		Left eye injured. While driving one of the loco. the gauge glass broke off and steam hurled at his left eye.
211	Nov. 9	Consolidated Asbestos, Ltd	Labourer	17	Back bruised, while hoisting bags in cobbing mill, he barred his foot against a bag causing him to fall.
212	Nov 9	Canadian Johns-Manville Co., Ltd.	Brakeman		Kicking drawbar of car foot slipped and was caught between two drawbars and crushed.
213	Nov 10	Bennett-Martin Asbestos & Chrome Mines, Vimy Ridge mine.	Tinsmith		Right hand cut by piece of tin while at work in machine shop.
214	Nov. 10	O. Martineau & Fils, Ltée, Rosemont quarry.	Stone cutter	36	While placing a piece of rock on bench of gang saw it fell on his right leg, fracturing it
215	Nov. 13	Canadian American Copper Refining Co.	Labourer		Thum blow off by premature blast.
216	Nov 13	Standard Lime Co, Ltd	Driller	27	Struck by fall of rock while drilling in the quarry. Left shoulder dislocated, and broken foot.
217	Nov. 14	Canadian Johns-Manville Co, Ltd.	Labourer		Jumped from rear footboard of loco. to avoid being crushed between tender and car approaching train stumbled and fell outside track over air pipe
218	Nov. 15	Consolidated Asbestos, Limited	Shoveler	18	Left leg bruised. While cars coupling underground, drawbar slipped and he had his foot caught between car and locomotive.
219	Nov. 15	Canadian Johns-Manville Co., Ltd.	Engineman		Cut to finger. In opening window on locomotive, hand slipped and went through the window.
220	Nov. 15	Bennett-Martin Asbestos & Chrome Mines, Ltd, Vimy Ridge mine.	Labourer		Nose badly smashed. While unloading a heavy dryer part, a board broke and one end struck him in the face.
221	Nov 16	Bell Asbestos Mines	Driller	24	Contused left shoulder. Fell while carrying drill.
222	Nov. 18	Montreal Quarry, Ltd	Quarryman	40	While loading car in quarry stone fell crushing his foot.
223	Nov. 18	Asbestos Corporation of Canada, Ltd, Beaver mine.	Labourer		Ruptured in lifting heavy asbestos bags, in mill.

224	Nov.	18	Quebec Asbestos Corporation	Brakeman	20	Right leg fractured, ribs broken and left shoulder crushed. The train was started while this man was underneath cars placing chains to reinforce couplings.
225	Nov.	20	Quebec Asbestos Corporation	Labourer	....	Finger caught in gears in trying to remove rock which had fallen underneath these gears.
226	Nov.	23	Bell Asbestos Mines	Labourer	....	Contusions to right side of body, fell while going down rock dump.
227	Nov.	23	Canadian Johns-Manville Co., Ltd.	Miner	....	Back of hand scratched while at work in open cast pit, did not pay attention to wound infection set in.
228	Nov.	24	The Dominion Lime Co.	Quarryman	....	Finger fractured by fall of rock.
229	Nov.	27	Quebec Asbestos Corporation	Shoveler	....	Legs fractured, fell into raise when shovelling around steam-shovel in bottom of open cast pit.
230	Nov.	27	Asbestos Corporation of Canada, Ltd., King mine.	Box loader	....	Finger bruised, struck by stone.
231	Nov.	29	Sherbrooke Saguenay Mica, Ltée.	Labourer	25	Struck on back by stone which fell from side of pit, during thaw.
232	Nov.	30	Canadian Johns-Manville Co., Ltd.	Crusherman	....	Abrasion of left hand, while pushing rocks into crusher, he had hand caught between two rocks.
233	Nov.	30	Consolidated Asbestos Ltd.	Yardman	63	Right shoulder dislocated, slipped and fell in yard.
234	Nov.	30	Asbestos Corporation of Canada, Ltd., King mine.	Box loader	....	Right foot bruised. Stone struck his foot.
235	Dec.	1	Asbestos Corporation of Canada, Ltd., British-Canadian mine.	Labourer	....	Bruises over body. Stone rolled from jam.
236	Dec.	1	Johnsons Co.	Labourer	....	Brain contusion. A small rock fell from a descending cable-derrick box and struck him on head.
237	Dec.	1	Consolidated Asbestos, Limited	Cobber	19	Cut to right hand and infected. In taking crude to table.
238	Dec.	5	Canadian Johns-Manville Co., Ltd.	Engineman	....	Burn both hands and wrists severely. Water glass gauge on locomotive broke.
239	Dec.	6	Canadian Johns-Manville Co., Ltd.	Machinist	....	Contused left leg. The bar used in prying car slipped and the man fell backward.
240	Dec.	7	Asbestos Corporation of Canada, Ltd., Beaver mine.	Labourer	....	Ruptured when lifting asbestos bags in mill.
241	Dec.	7	Asbestos Corporation of Canada, Ltd, King mine.	Labourer	....	Right foot injured by falling stone in yard.
242	Dec.	8	Canadian Johns-Manville Co., Ltd.	Millhand	....	Arm nearly completely severed when caught arm in gear of machinery while oiling in mill.
243	Dec.	9	Asbestos Corporation of Canada, Ltd., British-Canadian mine.	Labourer	....	Face burnt when car of carbide exploded in yard.
244	Dec.	10	Asbestos Mines, Ltd.	Miner	42	Struck by pulley while fighting fire in mill.
245	Dec.	11	Asbestos Corporation of Canada, Ltd., King mine.	Labourer	....	Contusion of chest. Squeezed between cars and box in yard.
246	Dec.	11	Consolidated Asbestos, Limited	Foreman	....	Several bruises on head and body. Rock from roof of drift fell on him.
247	Dec.	11	O. Martineau & Fils, Ltée, Papineau quarry.	Quarryman	40	Wound to right eye. While breaking stone with sledge hammer, small piece of rock struck him in the eye.
248	Dec.	16	Asbestos Corporation of Canada, Ltd., King mine.	Miner	....	Struck on right leg by stone, in open cast pit.
249	Dec.	16	Asbestos Corporation of Canada, Ltd., King mine.	Millhand	....	Missed step and fell, sprained back.
250	Dec.	18	Asbestos Corporation of Canada, Ltd., King mine.	Box loader	....	Struck on left knee by stone, in open cast pit.

NON-FATAL ACCIDENTS 1922

No.	Date	Name of Operator	Occupation	Age	Nature of Wound and Cause of Accident
251	Dec. 18	Canadian Johns-Manville Co., Ltd.	Labourer	....	Contusion right instep. Whilst loading rails on flat car, one rail rolled off and fell on his foot.
252	Dec. 18	Asbestos Corporation of Canada, Ltd., King mine.	Box loader	....	Stone struck his hand bruising finger in open cast pit.
253	Dec. 19	O. Martineau & Fils, Ltée, Rosemont quarry.	Stone cutter	30	Stumbie and had arm caught in gear of stone cutting saw.
254	Dec. 20	Bennett-Martin Asbestos & Chrome Mines, Ltd., Vimy Ridge mine.	Labourer	....	While hammering on a cold chisel to cut a rail, piece of it hit him on the right eye brow making a deep cut.
255	Dec. 23	Asbestos Corporation of Canada, Ltd., King mine.	Box loader	....	Stone fell on his hand and bruised finger, in open cast pit.
256	Dec. 26	Asbestos Corporation of Canada, Ltd., Beaver mine.	Box loader	....	Sprained his back when lifting a stone in loading cable-derrick box.

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